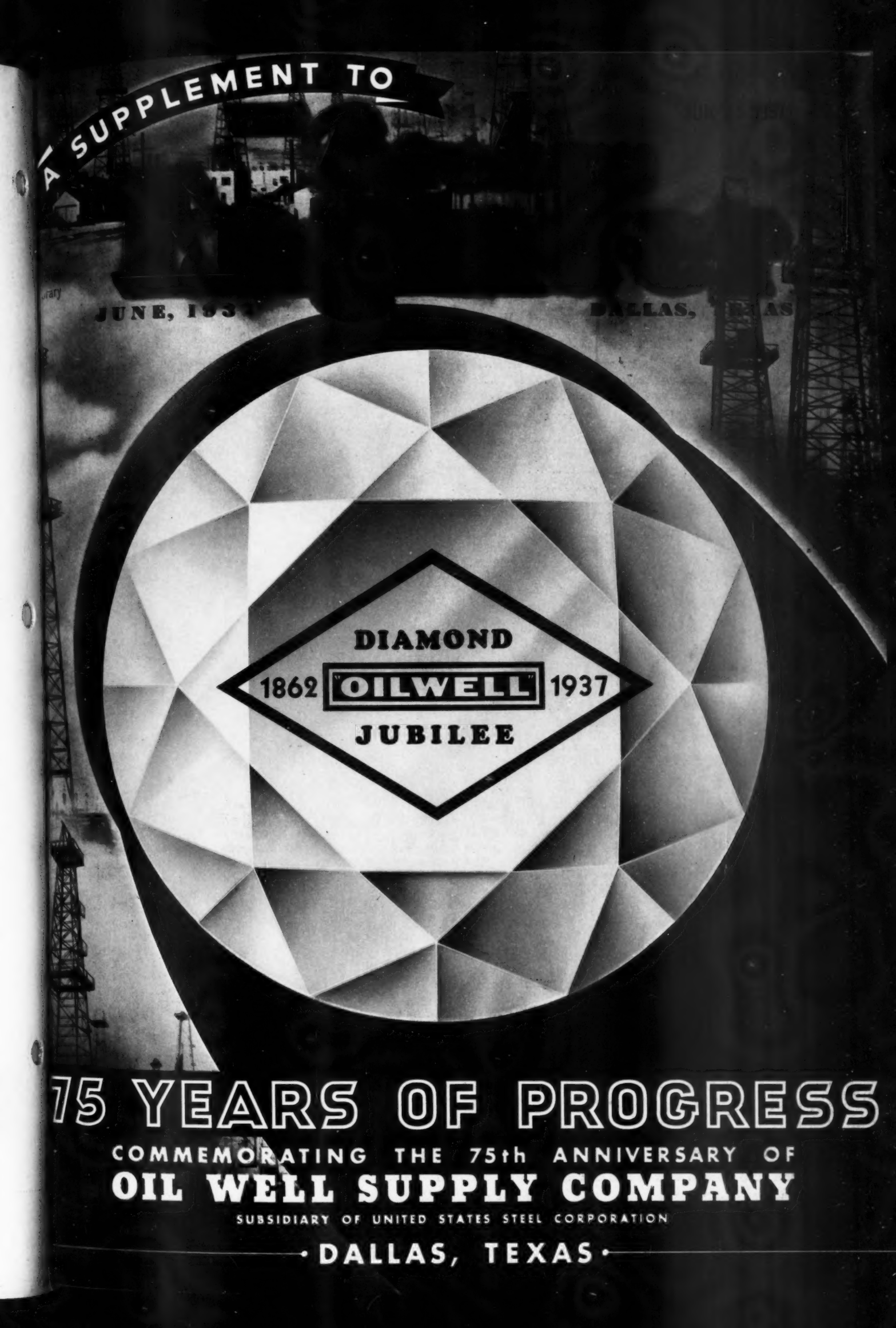
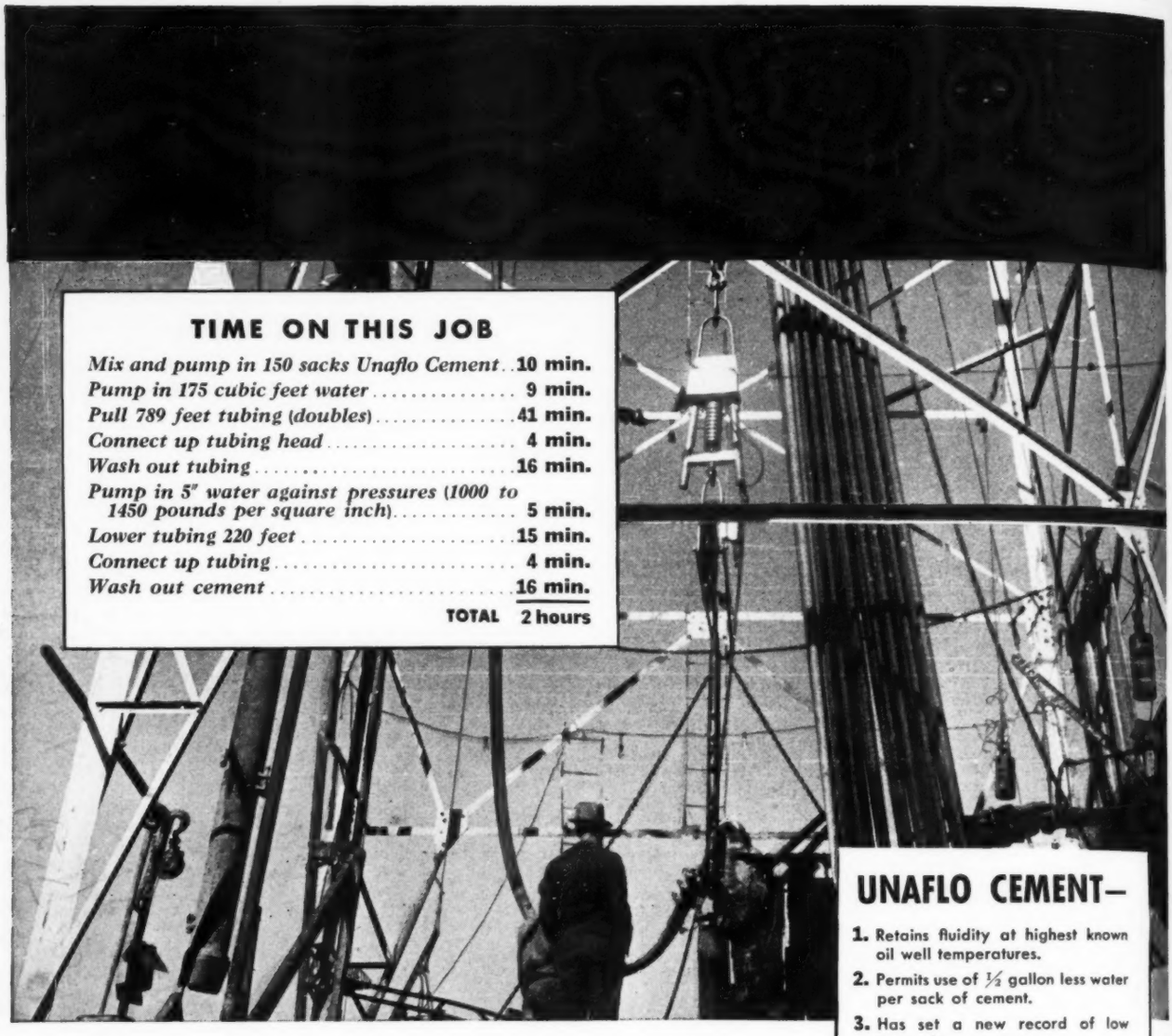

A SUPPLEMENT TO
JUNE, 193
DALLAS,
DIAMOND
1862 "OILWELL" 1937
JUBILEE
75 YEARS OF PROGRESS
COMMEMORATING THE 75th ANNIVERSARY OF
OIL WELL SUPPLY COMPANY
SUBSIDIARY OF UNITED STATES STEEL CORPORATION
DALLAS, TEXAS



TIME ON THIS JOB

Mix and pump in 150 sacks Unaflo Cement	10 min.
Pump in 175 cubic feet water	9 min.
Pull 789 feet tubing (doubles)	41 min.
Connect up tubing head	4 min.
Wash out tubing	16 min.
Pump in 5" water against pressures (1000 to 1450 pounds per square inch)	5 min.
Lower tubing 220 feet	15 min.
Connect up tubing	4 min.
Wash out cement	16 min.
TOTAL	**2 hours**

UNAFLO CEMENT—

1. Retains fluidity at highest known oil well temperatures.
2. Permits use of ½ gallon less water per sack of cement.
3. Has set a new record of low pump-down pressures.
4. Follows irregularities of well bore and casing.
5. Attains full strength rapidly under high temperatures.
6. Remains fluid even when contaminated by mud.
7. Remains fluid while being placed, thus forming an impermeable seal against the movement of formation fluids.
8. Has proved in the field that it "sets up" in sulphate waters.
9. Has repeatedly remained fluid for more than two hours on squeeze jobs where pressures and temperatures were extreme.
10. Is a safer cement for oil string and repair jobs.

● An Oklahoma City well was found to have 259 feet of open hole below the 7-inch shoe at 6122 feet. To plug back, tubing was lowered to 6113 feet, and water pumped in for more than two hours without returns.

150 sacks of Unaflo Cement were mixed into a heavy slurry, pumped into the tubing and partially displaced with 175 cubic feet of water.

The tubing was lifted 789 feet by pulling twelve doubles and one single, and flushed. The cement was squeezed at 1450 pounds per square inch.

After applying the squeeze there still remained an excess of 220 feet of cement in the casing. After one hour and 44 minutes, the tubing was lowered 220 feet into this cement which had been subjected to temperature and pressure; circulation was reversed and the excess cement (220 feet) was washed out through the tubing in 16 minutes. A perfect job completed with the top of the cement body exactly where the operator wanted it.

Unaflo made it possible to complete the job without moving in tools to drill out the excess cement. Try Unaflo on your next job.

Universal Atlas Cement Co. (United States Steel Corporation Subsidiary), Amicable Bldg., Waco, Texas; Kansas City; Tulsa; Oklahoma City.

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FOR SAFE DEEP-WELL CEMENTING

UNAFLO

THE Petroleum Engineer

"OILWELL" SUPPLEMENT
JUNE » » » 1937

A MAGAZINE OF METHODS FOR OPERATING MEN

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75 Years of Progress

THIS year Oil Well Supply Company is celebrating its seventy-fifth anniversary as a supplier of tools and equipment to the oil industry.

"Oilwell" came into being in 1862. Its beginning was inspired in the mind of John Eaton at the very start of the oil industry itself, signalized by the Drake Well in 1859. John Eaton became known as the father of the supply business in succeeding years while he and his associates undertook to solve the tool and equipment problems of the oil industry.

The tools used in drilling the early wells were all fashioned by hand to meet local needs. "Oilwell" pioneered them. Then the earliest standardized tools were offered to a rapidly-expanding industry eager for better equipment. "Oilwell" pioneered such standardization. Soon the increasing complexity of drilling and producing problems required an engineering organization to advance along a still wider front. "Oilwell's" leadership in engineering and design was always apparent. "Oilwell" has constantly kept faith in meeting more and more exacting requirements.

The exacting requirements of today "Oilwell" recognizes as engineering problems not readily solved. The cry of recent years for heavier and heavier equipment to drill deeper and deeper, "Oilwell" has challenged in a most important respect. That challenge takes shape in equipment to drill *cheaper* as well as deeper. This calls for advanced engineering to substitute improved design instead of merely increasing the size and weight of the tools of yesterday.

This new pioneering of more efficient and more economical equipment is a most significant phase of "Oilwell's" 75 years of progress. Today's equipment job is to drill *cheaper,* to produce from any depth *more economically.*

The following pages present a resumé of Oil Well Supply Company's newly-engineered equipment. These pages are dedicated to "Oilwell's" new pioneering at the close of 75 Years of Progress—at the beginning of a new era of engineering development.

Engineered Equipment by Oil Well Supply Co.

MANUFACTURERS of equipment for any branch of industry succeed or fail in accordance with the degree to which their engineering is advancing or declining. Successful engineering is based largely on experience. "Oilwell's" 75 years of continuous contact with the drilling and production of oil and gas wells provide this necessary background. Realizing that the design and manufacture of certain important items of machinery and equipment used in the oil fields could be controlled only by the supplier of such equipment, "Oilwell" provided itself with facilities suitable for this purpose at a very early period in the life of the oil industry. As "Oilwell" continued to grow with the industry these facilities were enlarged and expanded to keep pace with its growth as a supplier. Today, equipped with the most modern manufacturing plants, "Oilwell" is capable of producing many car-loads of equipment each month. A field service department is maintained to assist the user of the equipment in obtaining the maximum in satisfactory performance, and also a complete engineering and research department for determining by what methods and means the increasingly severe and exacting requirements of the oil industry may be met. In addition to its own extensive facilities, available for its use are the unlimited scientific and metallurgical resources of the United States Steel Corporation, of which it is a subsidiary.

"Oilwell's" enviable position as a leader in the industry, its world-wide distribution facilities, and its extensive list of satisfied customers, which includes operators from the largest major company to the smallest individual well owner, testify to the sincerity, intelligence, and tenacity with which it has attacked the problems of the oil industry and used the facilities placed at its command.

It is a cardinal principle with "Oilwell" that each new item developed must undergo extensive shop tests—tests that duplicate and in many instances exceed the severest field service—before it is sent to the field for field testing. No exceptions are made to the rule that an article of new design may not go into production before exhaustive shop and field tests have been made. In this manner design, workmanship, and material are thoroughly checked for their suitability for the service intended before the item is offered to the trade. The user is thus protected against shutdown time caused by inferior quality. After an article is put on the market each unit, wherever the type permits, is given a running test before shipment and all parts that operate under pressure are given an hydrostatic test of at least twice the normal working pressure.

"Oilwell" operates its own gray-iron foundry, which has a capacity of more than 600 tons per month of castings of all sizes. This department has modern equipment for the economical and high-quality production of various grades of semi-steel and nickel-iron castings weighing from a few pounds each to large slush pump castings weighing many thousands of pounds. An examination of the wide range of products turned out by this department testifies to the extreme care exercised in making and maintaining in good condition the pattern equipment, the skill and close supervision given to the preparation of cores and moulds, and the close attention paid to the composition, melting, and pouring temperature of the metal itself. In many instances coupons or test samples are taken from each casting and permanent records kept of chemical analysis and physical properties.

Oil Well Supply Company's Imperial Works at Oil City, Pennsylvania, is the world's largest plant devoted exclusively to the manufacture of oilfield equipment

DIAMOND 1862 OILWELL 1937 JUBILEE
75 years of progress

"Oilwell" also operates its own steel foundry, which makes electric steel only. This department has a capacity of more than 250 tons a month and produces castings as large as 2½ tons in weight. Electric-furnace steel castings are more expensive to make but, as is well known, they possess notably superior qualities of uniformity, soundness, finish, and strength. As in the iron foundry, the production of the best possible steel castings is paramount, and the high quality makes itself apparent in the finished product.

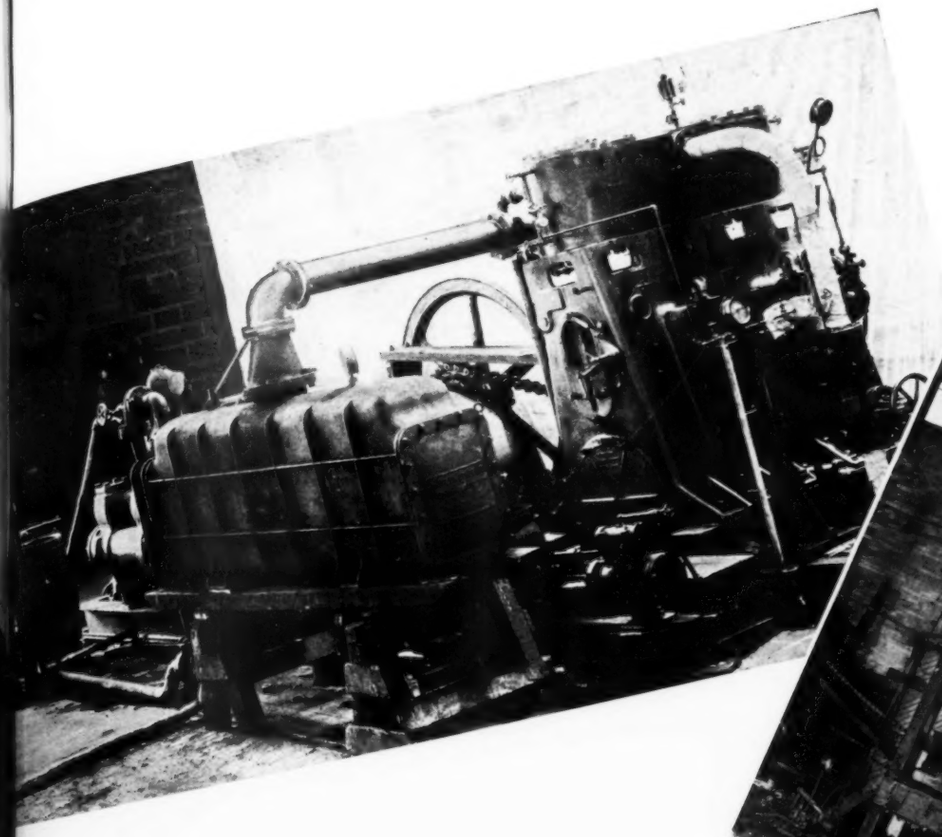
"Oilwell" produces all its own forgings, including the complete range of sizes from small drop forgings to large shafts and cable-tool stems, bits, etc. The forge plants are fully equipped with pyrometer-controlled heating and annealing furnaces and an extensive variety of hammer equipment for the wide range of products manufactured. Permanent and accurate records are kept for each product, including records of the heat from which the forging billet was made at the steel plant, so that any piece can be traced readily with regard to any peculiarities that may develop during manufacture and use. The production of a uniformly high-quality product cannot be assured without constantly exercising due care such as outlined.

The machine-tool equipment with which the multiplicity of machining operations are performed is of the latest and most efficient type combining accuracy with economical production costs. Of more importance are the tool-room facilities, the jigs and gauges, and the thorough system of inspection of the work as the various parts pass through the machining and assembling operations. Interchangeability of parts is vitally important, because "Oilwell" equipment being in use in practically every oil field in the world, replacement parts must fit when received so that there will be a minimum of down-time when repairs are necessary. Repeated duplication of product can result only from the use of accurately-made jigs, gauges, and tools, and constant vigilance in the manufacturing plant to see that the tool equipment is kept at all times to the original standards.

To be most effective, progressive engineering must be supported by up-to-date manufacturing facilities. "Oilwell" believes it has maintained a well-balanced relationship between these two important factors during its many years of successful achievement in supplying the oil trade with high-quality equipment on a sound economic and commercial basis. It is "Oilwell's" chief aim to provide machinery and equipment that will drill and produce wells at the lowest first cost and minimum operating expense.

During its 75 years of experience "Oilwell" has made innumerable improvements to the machines, tools, and equipment used in the oil industry. Some of the most recent developments and accomplishments are dealt with in some detail in the following pages.

Each new item of "Oilwell" equipment must undergo extensive shop tests duplicating or exceeding severest field requirements. The illustration at the left shows an "Oilwell" Vertical Twin-Cylinder Steam Engine rigged-up with surface condenser for steam economy test



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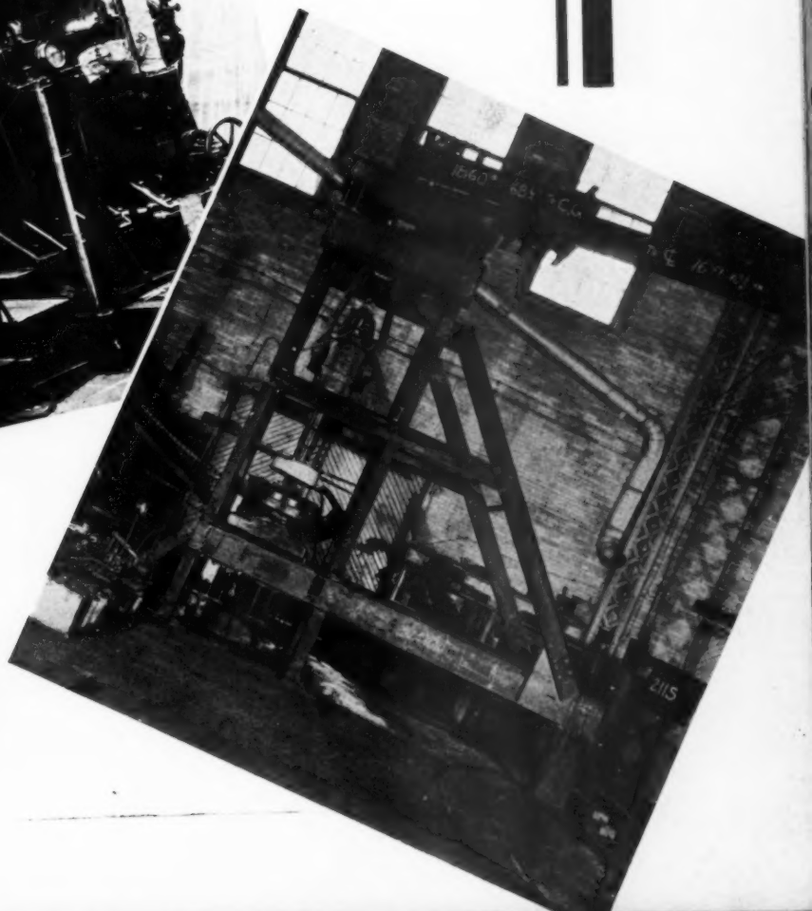
75 years of progress



At the right is shown the massive frame used for shop-testing new swivel designs under loads equaling 175 to 200 percent of nominal ratings. Following exhaustive testing at the factory, each new "Oilwell" development must be thoroughly field tested

Modern Power Plant for Steam Drilling Rig

Completely equipped with modern "Oilwell" Steam-Saving Machinery, this heavy-duty rig near Ada, Oklahoma, uses only one-third of the quantity of fuel and feed-water required by conventional rigs on surrounding locations. A single 125-hp. boiler supplies ample steam for all requirements

SELECTING as a major project the improvement of steam-driven rotary drilling rigs, "Oilwell" engineers have devoted much time and effort to the problem of modernizing the power plant of this type of rig to make it comparable in efficient performance with modern stationary power plants. Until "Oilwell's" rather recent efforts to provide more economical steam-generating and steam-using equipment, which has resulted in the modern machinery now available, extravagant practices in the generation and use of steam made the steam drilling rig most uneconomical. With the new "Oilwell" steam-saving equipment a reduction in the consumption of both fuel and water of approximately 60 percent is being regularly attained under actual field conditions. This outstanding accomplishment has been made possible by the extensive background and experience of "Oilwell's" engineering department.

In 1929 the Wilson-Snyder Manufacturing Corporation became a subsidiary of the Oil Well Supply Company. This well-known pump manufacturer has a history dating back to 1874, and during its existence has survived as a result of designing and building a wide variety of heavy-duty pumps of all types for steel mill, refinery, and pipe line service; and in later years the widely-known Wilson-Snyder steam and power slush pumps. Wilson-Snyder has also been building, since 1920, a full range of sizes of Erie Ball stationary steam engines of both the single- and four-valve types and has a background of experience in this type of work extending over 40 years.

Steam has been used as the preferred source of motive power for drilling rigs since oil was first produced from drilled wells. Just as it was necessary before the introduction of electric power transmission lines and internal combustion engines of the portable type, steam is preferred today because of the capacity, simplicity, reliability, and economy of the equipment available. The average drilling crew has a good working knowledge of the steam rig from the boilers to the engines and pumps and can take care of this type of equipment without difficulty. This is very important from the standpoint of shut-down time and maintenance expense. Steam equipment has been modernized without sacrificing this important point of simplicity and the crew is not burdened with any complex machinery with which it is not familiar. Rigging-up time has been substantially reduced and the work simplified.

Fuel and water at some drilling locations are quite expensive and scarce and at many others cheap and plentiful, but regardless of low cost and ample supply their value is appreciable even under the most favorable conditions. "Oilwell's" steam-saving equipment is economically applicable under all circumstances, particularly as its first cost is not higher than that of conventional equipment and it is actually more portable, both as to total weight and as to the number of pieces (especially boilers) to be handled. With this equipment one boiler and a superheater will do the same work that formerly required a battery of three or four boilers.

"Oilwell" has provided advanced equipment for the reduction of fuel and water consumption at each of the following points in a drilling rig where opportunities for a saving are present:

1. Feedwater heating.
2. Boiler efficiency.
3. Superheating of the steam.
4. Slush-pump prime mover.
5. Rotary prime mover.
6. Boiler insulation.

Feedwater Heating

THE practice of heating the feedwater for drilling-rig boilers has been followed more or less indifferently for the past several years. In most instances the equipment has consisted of a coil of pipe in the discharge line from the feed pump, the coil being placed inside a large pipe or shell to which exhaust steam from the pumps and engines is admitted for heating the water by conduction. This is known as the closed type of heater. If sufficient surface for heat transfer is provided to heat the required amount of water to 200 deg. fahr., the closed heater becomes large and cumbersome. Actual temperatures taken in the field indicate that heaters of this type in use generally are not large enough when originally made; also their efficiency is rapidly impaired by scale, which forms both on the inside and the outside of the coil and thus interferes with heat exchange. It is very unusual to find feedwater temperatures greater than 130 deg fahr. in heaters of this type.

"Oilwell" has developed a combined feed pump and heater unit that utilizes the same principle as the jet condenser for heating the feedwater. This is known as the open-type heater and in it the cold feedwater, as it is sprayed through a spring-loaded valve, comes into direct contact with exhaust steam and mixes at a pressure of approximately 10 lb. per sq. in. gauge. The temperature of the feedwater is thereby increased to approximately 210 deg. fahr., which is within 15 to 25 deg. fahr. of the temperature of the exhaust steam in the heater chamber. The heater is of sufficient capacity to produce the above results in a boiler plant developing 800 boiler horsepower.

Detailed information on the "Oilwell" Feedwater Heater-Pump Unit is given in "Oilwell" Bulletin No. 110-A.

Feedwater heated to 210 deg. fahr. requires 13 percent less heat to convert it into steam at 250 lb. per sq. in. gauge than does feedwater at a temperature of 55 deg. fahrenheit. This is a very worth-while conservation of heat, as it utilizes at no cost the exhaust steam that ordinarily would be blown to the air.

There are other advantages resulting from the use of the open-type feedwater heater and though not related directly to heat conservation they result in pronounced operating economies. In this type approximately 15 percent of the total steam generated is condensed in the heater and returned to the boiler as distilled water, thus reducing the raw water used by that volume. The result is cleaner boilers.

The elements of temporary hardness in most feedwater are precipitated at about 200 deg. fahr., and with the open-type heater a portion of these precipitates forms scale in the heater chamber, the remainder passing into the boilers as a sludge, which does not scale the tubes but settles into the water legs, from which it is blown out. Scale in the heater chamber of the open-type heater does not reduce the heater efficiency until sufficient has formed to interfere with the operation of the float mechanism; whereas in the closed-type heater a relatively thin scale on the coil is very detrimental. The cleaning of the open-type heater is quite simple and easy to perform, as the heating chamber can be removed readily from the feed pump and cleaned through large openings provided for that purpose. Scale deposited in the heater chamber is eliminated from the boilers. This results in cleaner boilers.

Water heated to approximately 200 deg. fahr. liberates any free oxygen that may be present. This oxygen is vented from the heater chamber through an opening provided for the purpose. Free oxygen in boiler feedwater causes pitting; the open-type heater eliminates this condition and prolongs the life of the boiler.

Pumping cold feedwater into a boiler operating at a pressure of 350 lb. and generating steam at a temperature of 435 deg. fahr., causes local strains to be set up in the boiler that are incalculable but are known to be very severe. By raising the temperature of the feedwater to the highest practicable point these strains are greatly reduced, resulting in boilers free from leaks and prolonging their life.

So numerous are the advantages in the use of the oil-country open-type feedwater heater that no rig operator can afford to overlook the many benefits to be derived from its use.

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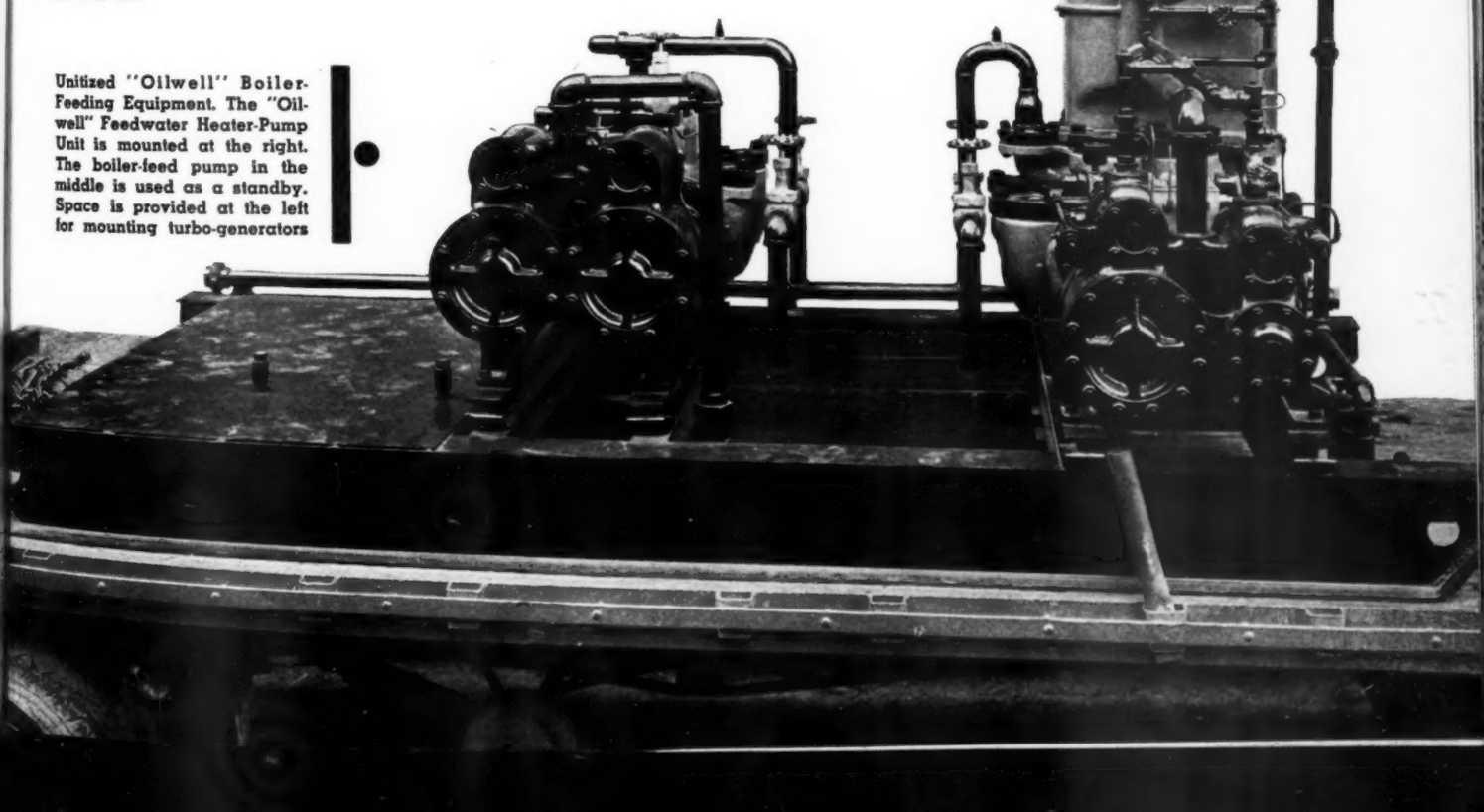
75 years of progress



Unitized "Oilwell" Boiler-Feeding Equipment. The "Oilwell" Feedwater Heater-Pump Unit is mounted at the right. The boiler-feed pump in the middle is used as a standby. Space is provided at the left for mounting turbo-generators

CAPACITY and EFFICIENCY

EVER since the Drake well was drilled fire-tube boilers have been preferred over water-tube boilers for drilling —and naturally so. The fire-tube boiler combines simplicity, portability, light weight per unit of evaporation, water-jacketed firebox, and unit construction. All these features are necessary, for the boiler plant must be mobile, capable of meeting a wide range of steam demands, and of such construction that normal repairs can be made in the field with portable tools.

Its basic design provides great steaming capacity per pound of weight. This is borne out by its universal use in steam locomotives on the railroads. Locomotive boilers regularly develop an evaporation rate of 15 lb. of water per sq. ft. of heating surface; whereas the A.S.M.E. rating of boilers is on the basis of one hp. (34.5 lb. of water) for ten sq. ft. of heating surface, or 3.45 lb. per sq. ft. of heating surface. In other words, the locomotive boiler in railroad service is operated regularly at almost five times the normal A.S.M.E. rating. This leads to the conclusion that oil-country boilers should be rated on their actual steam-generating capacity and not on the A.S.M.E. hp. rating.

Normally the average boiler on a drilling rig generates steam at a rate not exceeding twice (200 percent of) its A.S.M.E. rating and under such rate of operation is considered to be firing "hard". Tests made recently, but not yet published, indicate that by altering the relation somewhat between firebox heating surface and tube heating surface and taking the flue gases from the boiler tubes at a somewhat higher temperature than heretofore, and using this excess heat from the flue gas for other purposes before exhausting it to the atmosphere, an oil-field boiler can be efficiently operated at 350 percent of its A.S.M.E. rating. This method of operation, of course, can be achieved only by providing additional draft at the base of the boiler stack; but the first cost and also the operating cost of increasing the draft is small compared with the increased steaming capacity per lb. of weight in the boiler plant.

Tube size in oil-country boilers has been a point of controversy between boiler manufacturers and drilling operators for some time. Tests made some years ago and attested to by the U. S. Bureau of Standards show that tubes of small diameter are more efficient in heat transfer than tubes of large diameter. Certain operators object to small tubes of greater number in an oil-field boiler because of greater difficulty in cleaning and the slightly higher expense for tube replacement. On the other hand, the smaller tube construction results in a boiler of shorter barrel for equal heating surface and therefore a decrease in weight and bulk, hence greater portability. "Oilwell," about seven years ago, introduced and has advocated the 2¼-in. tube as against the 3-in. tube primarily because of its greater efficiency and the reduction in weight, and believes the objections of operators in most instances can be overcome by proper care and handling of boilers and that the boiler-cleaning and repair problem should be minimized by attacking the problem at its source—namely, by recovering condensate and using steam-saving equipment, both of which reduce the quantity of water to be evaporated. "Oilwell" recently has introduced the idea of using an air-cooled condenser for condensing the excess exhaust steam and returning it to the boiler as distilled water, thereby practically eliminating the raw scale-forming water and greatly reducing the necessity for cleaning and re-tubing.

Steam locomotive boilers invariably are constructed with 2¼-in. tubes. They operate under a wide range of load conditions and with a variety of feedwaters as do boilers on a drilling rig. Locomotive boilers far surpass oil-field boilers in performance and provide the boiler manufacturer and the user a concrete example of what can be done in oil-field operation when proper design and efficient rig operation are coordinated.

Specifications for "Oilwell" Boilers are given in Bulletin No. 159.

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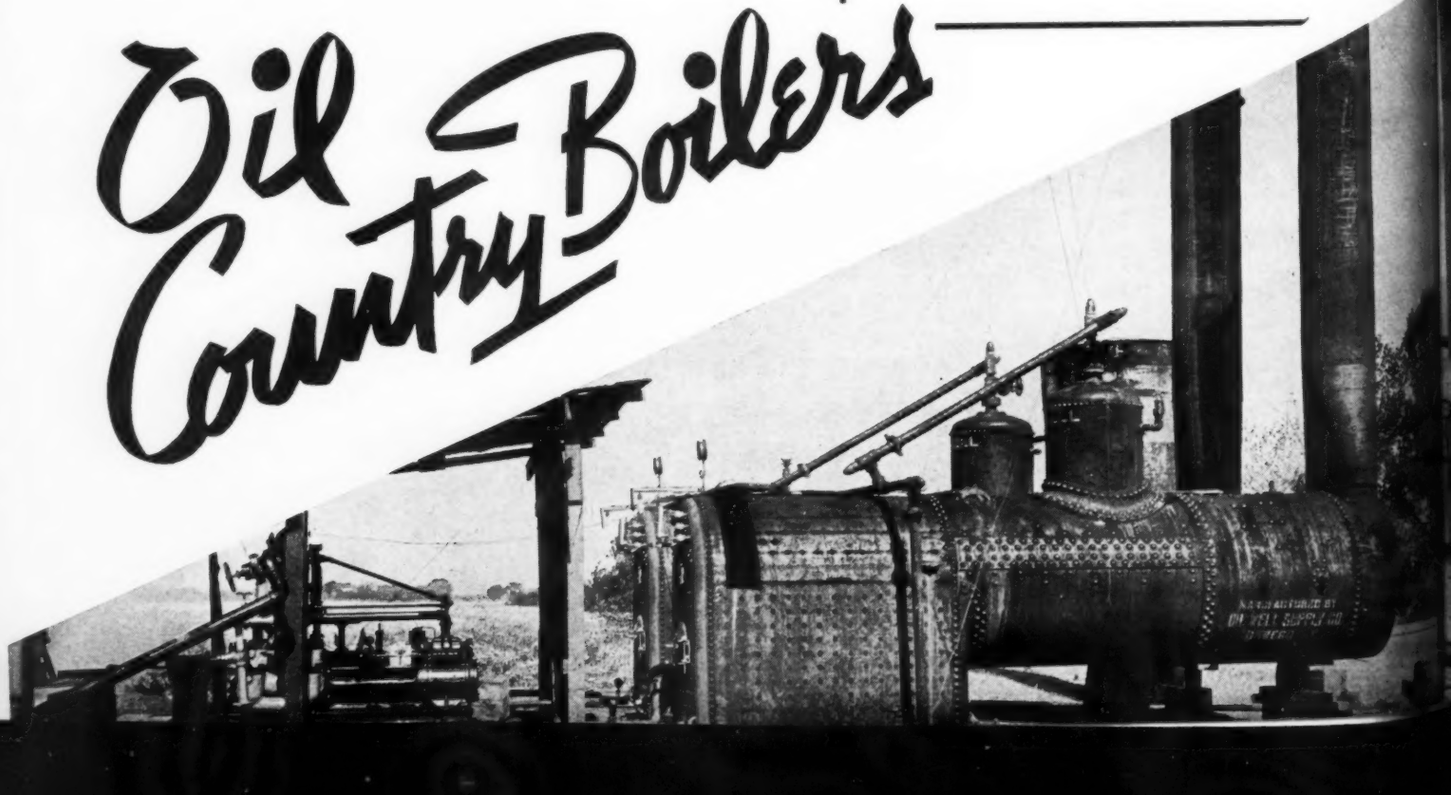
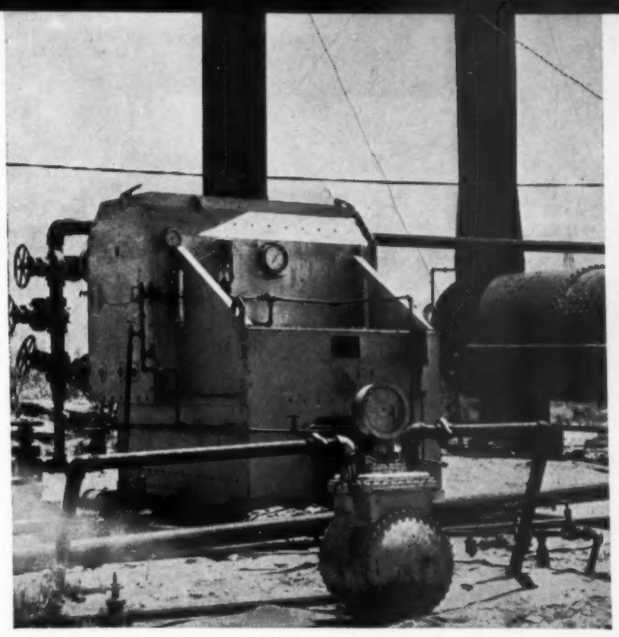
"Oilwell" Boilers on a wildcat location where fuel is scarce and high boiler efficiency is essential. The "Oilwell" Feedwater Heater-Pump Unit at the left supplies conditioned feedwater at 210° F.

Oil Country Boilers



Superheating Steam



By greatly reducing pressure-loss in a 290-ft. steam line, this separately-fired superheater makes possible the operation of an "Oilwell" Steam-Saving Rig in West Texas with the steam generated by a single boiler

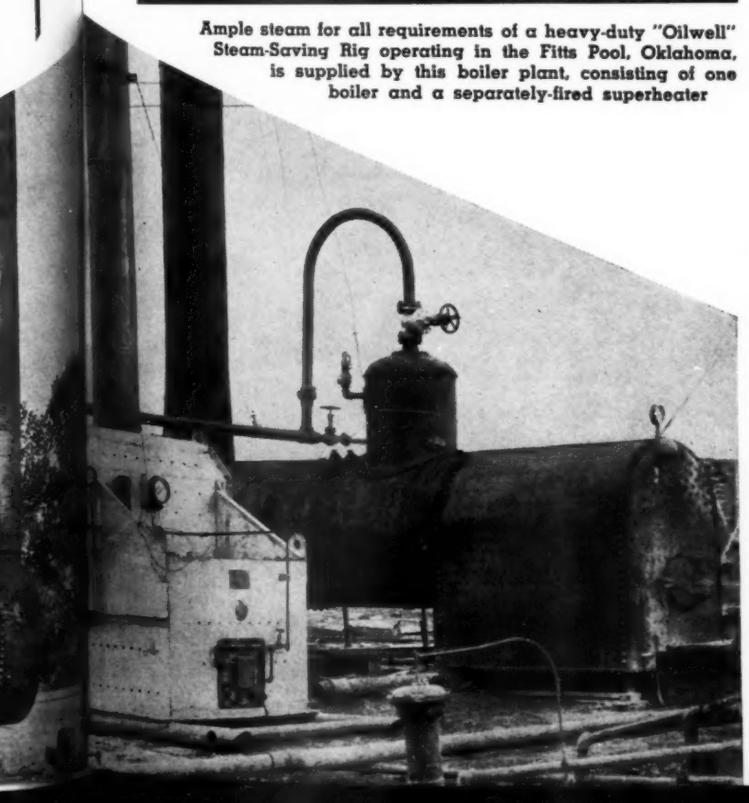
For the past four or five years superheating equipment has been available in two forms for drilling rigs. One is of the built-in type in which special superheating tubes are built into the boiler, replacing some of the regular evaporating tubes and incorporating the small-diameter superheating elements; the other is of the separately-fired type, consisting of an entirely separate unit that is placed in series in the main steam line leading from the boilers to the rig.

The specific volume (cu. ft. per lb.) of dry saturated steam at 350 lb. per sq. in. gauge is 1.27 cu. ft. per pound. The specific volume of steam at 350 lb. per sq. in. gauge superheated 100 deg. fahr. is 1.50 cu. ft. per pound. By applying 100 deg. fahr. of superheat an increase of 18 percent in volume of steam results.

Saturated steam at 350 lb. per sq. in. gauge has a total heat content of 1204 B.t.u. The total heat content of this same steam superheated 100 deg. fahr. is 1271 B.t.u., representing an increase of 5.6 percent. Thus, (for any given quantity of water evaporated) by increasing fuel consumption 5.6 percent, we add 18 percent to the volume of the steam when superheated 100 deg. fahrenheit. Stated conversely, the evaporation required of the boilers for a given volume output is only 85 percent of that required for saturated steam; also, the fuel burned under the boilers is only 85 percent of that required for saturated steam. The fuel used in the superheater must be taken into consideration and this results in a net fuel saving of approximately ten percent.

The power output of machinery on a drilling rig is in direct proportion to the volume of steam supplied; therefore, the net increase of 18 percent in the volume of steam generated for only a 5.6 percent increase in heat added recommends the use of superheated steam as of unquestionable value.

Ample steam for all requirements of a heavy-duty "Oilwell" Steam-Saving Rig operating in the Fitts Pool, Oklahoma, is supplied by this boiler plant, consisting of one boiler and a separately-fired superheater



Other notable operating improvements on a drilling rig result from the use of superheated steam. With saturated steam a noticeable amount of condensation and pressure loss occur in the long steam line from the boiler plant to the rig. Under ordinary conditions such condensation is eliminated entirely and the pressure loss greatly reduced when superheat of 100 deg. fahr. is used. The machinery operates more efficiently, lubrication is more effective, and the response to heavy demands is more prompt when dry or slightly superheated steam is used, because the mean effective pressure is increased. This was proved in a test made four years ago by Hu M. Harris and J. E. Eckel of the Humble Oil and Refining Company, and revealed in a paper presented before the Division of Production, A.P.I. meeting at Dallas, June, 1931.

In the built-in type of superheater it is impossible, once the lengths of the elements have been chosen, to control the amount of superheat obtained as this varies with each rate of firing, so that at low firing rates the amount of superheat may be lower than desired if the high firing-rate value is to be kept within bounds and vice versa; it having been found that the amount of superheat increases with the rate of firing. Modern pumps and engines are constructed of materials suitable for a maximum steam temperature of 600 deg. fahr., 550 deg. fahr. being preferred. This applies also to steam-line fittings ordinarily used; therefore, excessive temperatures must be guarded against. With the built-in superheater as it has been constructed it is not possible to bypass the superheater and use the boiler to provide saturated steam. When the superheater needs repairs, it results in shut-down of the entire boiler and the loss of its steaming capacity.

With the Foster Wheeler Separately-Fired Superheater now offered by "Oilwell," which has a rated capacity of 15,000 lb. of steam per hour at 100 deg. fahr. superheat, it is possible automatically to maintain a constant steam temperature, regardless of the quantity of steam required, up to the rated capacity of the superheater plus a reasonable overload. The main steam piping is arranged for bypassing the separately-fired superheater so that it can be cut out of service if desired.

The Foster Wheeler Separately-Fired Superheater distributed by "Oilwell" is described in Bulletin No. S-36-3.

The general use of superheated steam on drilling rigs, and the modern equipment provided to make its use possible, represent far-reaching economies and an increase in the capacity of the rig that no additional number of boilers can equal.

Steam-Engine Driven Slush Pump

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UNTIL "Oilwell" developed, a year or two ago, a high-speed twin vertical steam engine suitable for driving a power slush pump through chain or V-belt drive the direct-acting duplex steam pump was the only type available for use on a steam rig. The latter type of steam pump is inherently uneconomical in steam consumption, because the direct-acting pump valve gear has no provision for cutting off the admission of steam before the end of the stroke, for no fly-wheel effect is available. This precludes using any of the expansive force of the steam, and the steam used is measured entirely by the volumetric displacement of the steam pistons.

Under the most favorable conditions, the consumption of steam by this type of pump is not less than 60 lb. of steam per hydraulic hp. per hr. and under ordinary operating conditions is probably closer to 80 lb. per hydraulic hp. per hour.

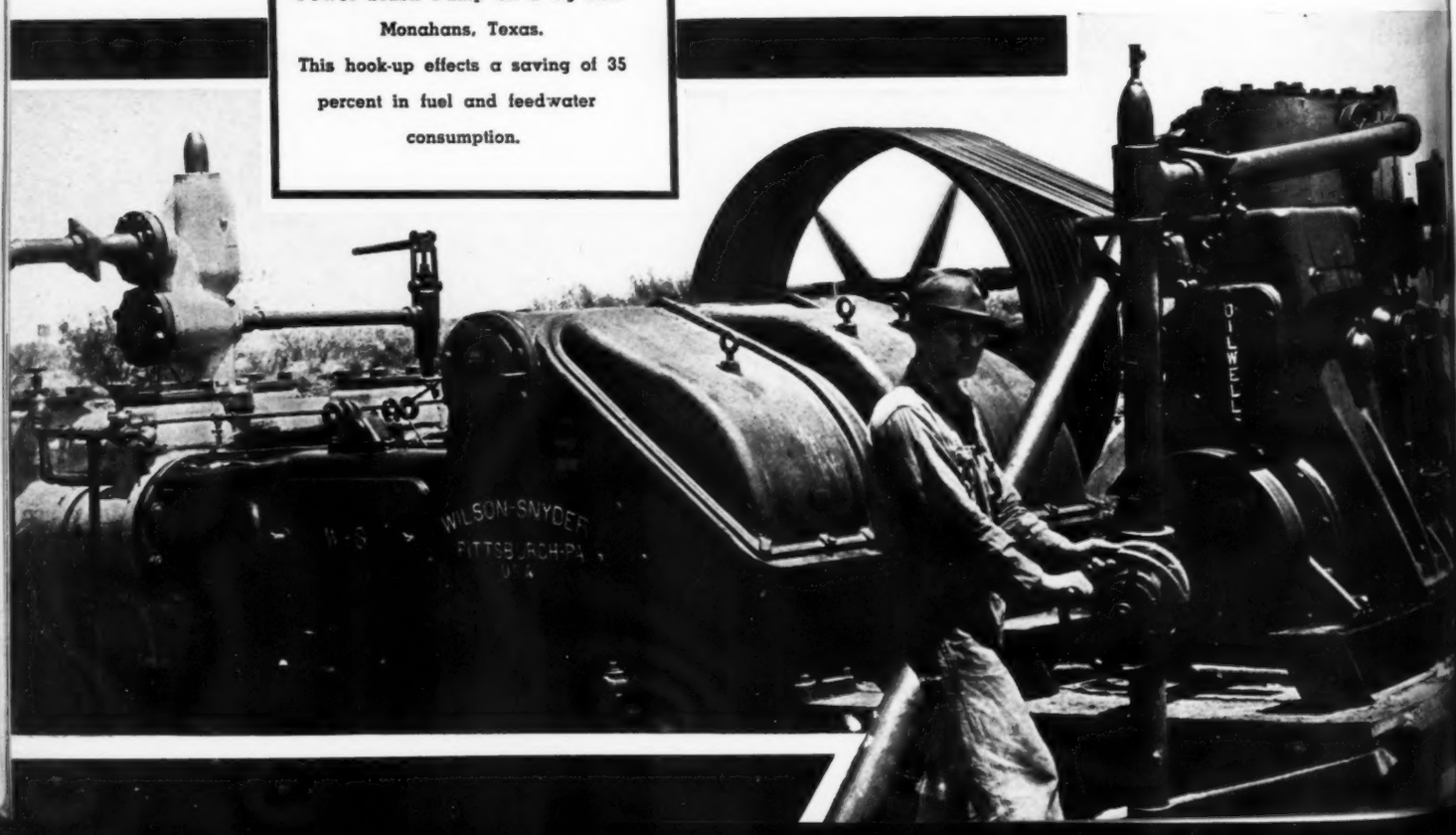
When used under normal conditions the steam-engine drive operates at a steam rate of 30 lb. per hydraulic hp. per hr., and even under the heaviest overloads does not exceed a rate of 40 lb. per hydraulic hp. per hour. According to the A.S.M.E. test of a rotary rig made in Oklahoma City by Prof. William H. Carson of the University of Oklahoma, the direct-acting slush pump consumes about 70 percent of the total steam generated. It will be seen, therefore, that a steam-engine-driven power slush pump will save about 35 percent of the total steam used over that required by a rig equipped with direct-acting steam pumps.

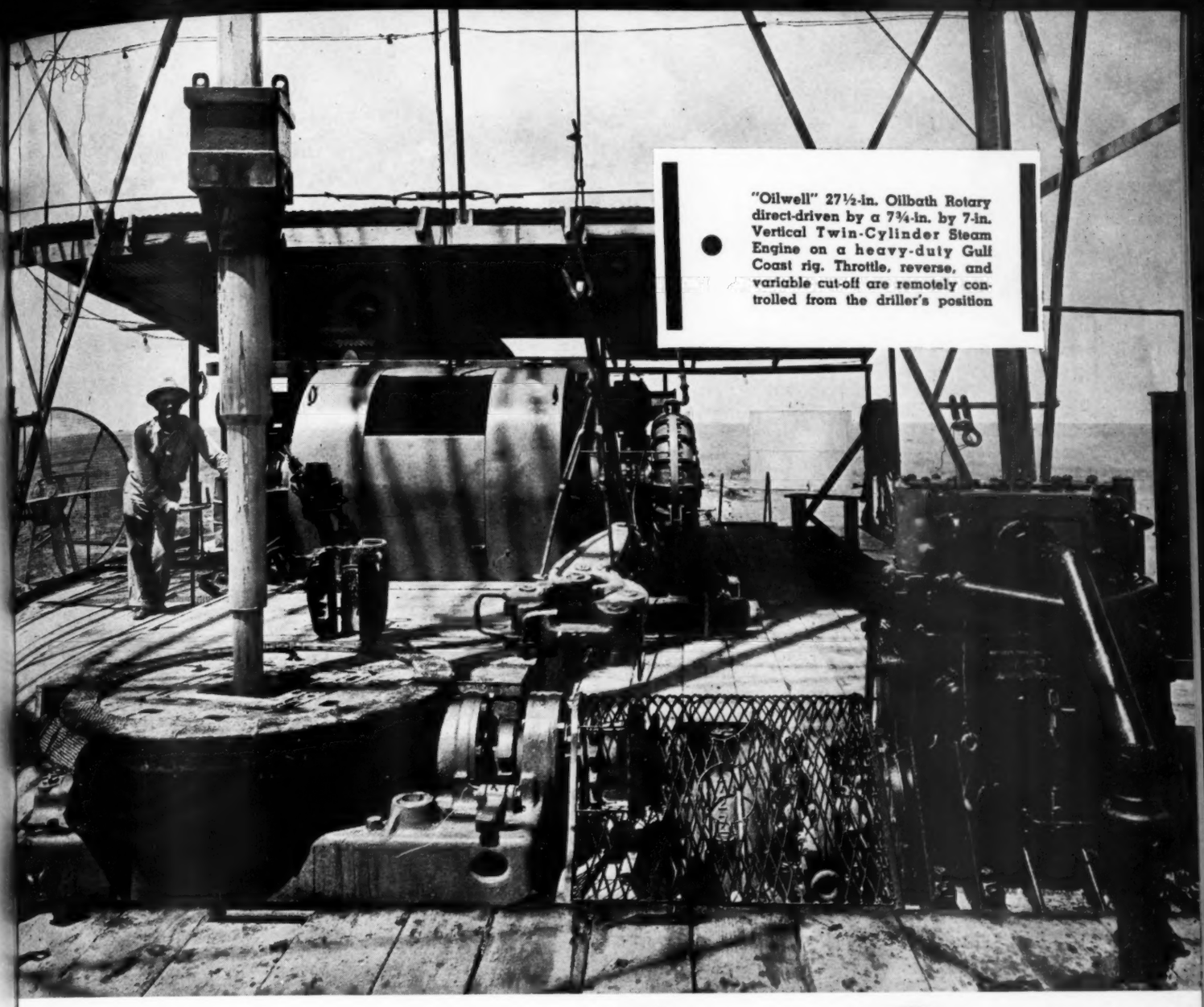
The engine is equipped with a hand adjustable cut-off control, which permits attaining the greatest possible steam economy for any and all operating conditions and loads. This cut-off device operates similarly to the valve gear on a steam locomotive and for the same purpose. It is well known that when starting a train the locomotive engineer adjusts, by hand, the valve gear so that the steam pistons receive full inlet steam pressure for practically the full stroke, and as the train accelerates he shortens the admission of steam to a point just sufficient to maintain the desired speed. In this way the expansive force of the steam is used to the best advantage from a standpoint of economy. It is by this same means that the engine-driven power slush pump far surpasses the direct-acting duplex pump in steam economy.

Any slush pump and its prime mover must be capable of developing the highest possible mud pressure when stalled if it is to be successful from a field-operating standpoint. The steam engine as a prime mover meets all the torque requirements of a slush-pump drive.

The steam-engine slush-pump drive represents the greatest single improvement in fuel and water consumption ever offered and in itself makes possible a reduction of 35 percent in the total boiler capacity required.

An "Oilwell" 7¾-in. by 7-in. Vertical Twin-Cylinder Steam Engine with hand-controlled variable cut-off driving a Wilson-Snyder 7¼-in. by 18-in. Power Slush Pump on a rig near Monahans, Texas.
This hook-up effects a saving of 35 percent in fuel and feed-water consumption.





"Oilwell" 27½-in. Oilbath Rotary direct-driven by a 7¾-in. by 7-in. Vertical Twin-Cylinder Steam Engine on a heavy-duty Gulf Coast rig. Throttle, reverse, and variable cut-off are remotely controlled from the driller's position

Direct Steam-Engine Drive for Rotary Table

THE "Oilwell" Direct Engine-Driven Rotary has a definite place as a steam-saving element on a modern drilling rig. Until recently it has been the universal practice to drive the rotary table with the hoisting engine through chain drives from engine to hoist and from hoist to rotary. The power required to drive the rotary table is so small in amount compared with the capacity of the hoisting engine, that the hoisting engine is operating at a very uneconomical load factor when driving the rotary table. This is especially true if the engine is not equipped with a device for shortening the cut-off so as to derive full steam economy from the expansive force of the steam and reduce the inefficiency due to throttling. It was in order to provide heat conservation at this point that "Oilwell" developed a separate steam-engine drive for the rotary table. This engine is much smaller than the regular hoisting engine, thus operating at a favorable load factor at all times, and is equipped with cut-off control. It is direct-connected to the rotary table through a gear box of suitable ratio to provide the desired range of rotary-table speeds. It is a twin vertical high-speed piston-valve engine and is mounted on a rigid self-contained structural frame with the rotary table. The entire assembly is moved as a unit and is always in alignment.

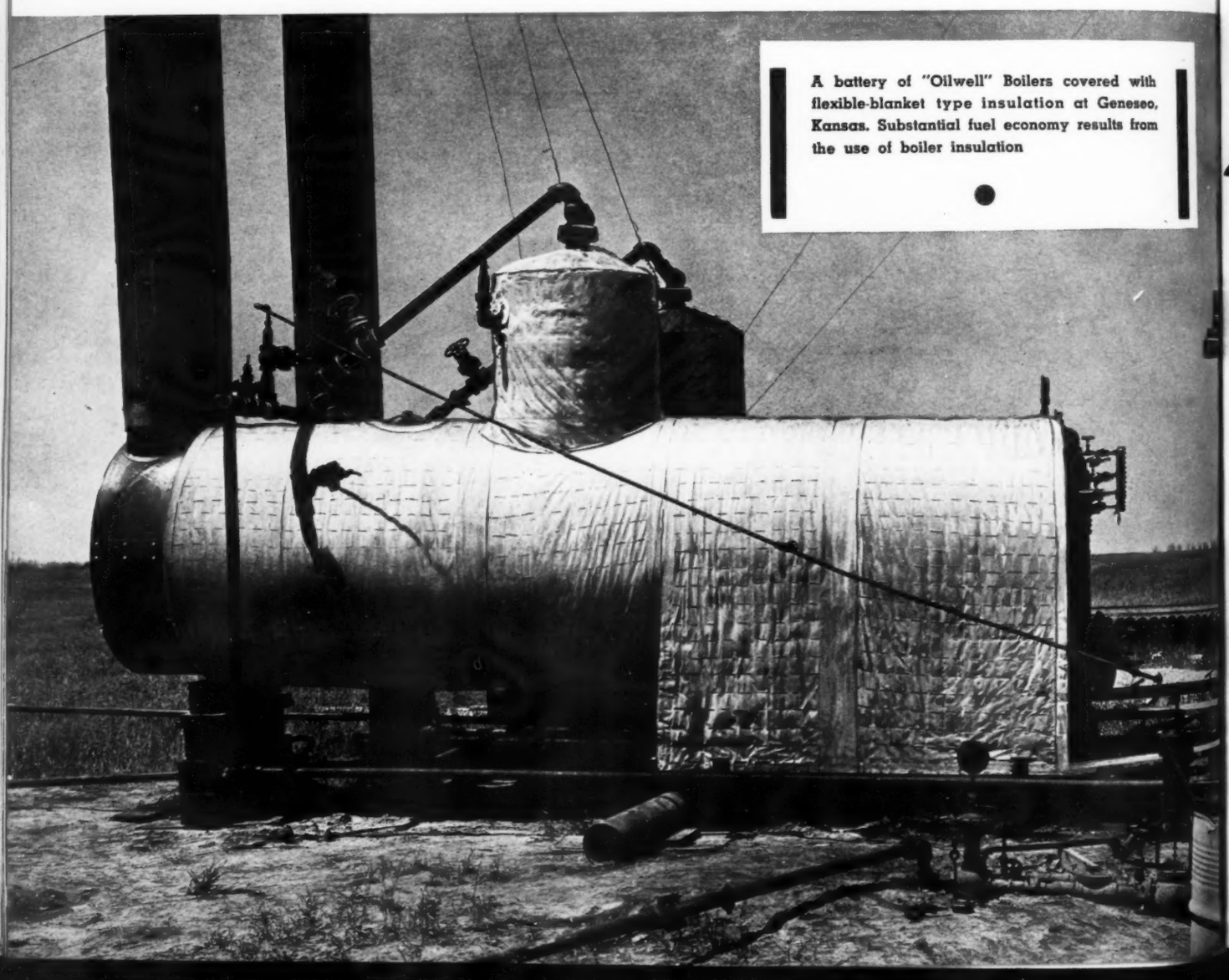
Power needed by the rotary table normally is about 20 percent of the total power consumed by the rig and it is estimated that the direct-driven rotary table will require 30 percent less steam than the chain-driven table, which obtains its power from the large hoisting engine. In other words, a saving amounting to six percent of the total steam generated is obtained with the direct rotary table drive and small engine. Many other advantages of the direct drive are pointed out elsewhere.

Detailed information is given in "Oilwell" Bulletin No. 145-A.

Insulation for Boilers and Steam Lines

ALTHOUGH the thorough insulation of boilers and steam lines is of considerable economic importance its general use probably has been unduly retarded by the cost of keeping the material in repair as the rig is moved from one place to another. It is believed, however, that once the drilling operators become heat-conservation minded boiler and steam-line insulation will be used more widely. As determined by Hu M. Harris and J. E. Eckel in tests made in 1931, a loss by radiation, convection, etc., of 23.8 percent occurs when the boilers are unprotected by a house and are not insulated. This figure will vary according to weather conditions, but under the most favorable conditions these losses are quite appreciable. As an example, radiation losses from bare steam pipes may be expressed as 4.04 B.t.u. per sq. ft. per deg. per hour at a temperature difference of 400 deg. fahrenheit. A 4-in. steam line 200 ft. long has 236 sq. ft. of radiating surface. The loss based on the above would be 382,000 B.t.u. an hour, assuming quiet surrounding air; if a strong wind is blowing or if it is raining, the loss would be much greater. The total heat in one lb. of saturated steam at 250 lb. per sq. in. gauge is 1201 B.t.u. The radiation loss, therefore, is equivalent to the quantity of heat required to evaporate 320 lb. of water per hour at 250 lb. per sq. in. gauge pressure. This favorable example results in approximately two percent loss of the total hourly average of water fed to the boilers as given in Professor Carson's A.S.M.E. test at Oklahoma City. Considering adverse weather conditions, steam lines submerged in water, as they often are, and many other such unfavorable factors, a loss of 20 percent or more due to radiation and convection from uncovered boilers and steam lines is easy to understand.

Boiler insulation is now available of the metal-jacketed sectional type and the less expensive flexible-blanket type that can be removed easily from the boiler when moving and replaced with little trouble and damage. Steam-line insulation of the sectional type also is available; the elimination of heat losses and consequent savings in steam that accrue from its use justify its general adoption in the oil fields.



A battery of "Oilwell" Boilers covered with flexible-blanket type insulation at Geneseo, Kansas. Substantial fuel economy results from the use of boiler insulation

FIELD TESTS ON STEAM-SAVING ROTARY DRILLING RIGS

Location	Dia. of Hole inches	Dia. of Drill Pipe inches	Feed-water Temp. °F.	Temperature of Superheated Steam °F.	Engine-driven Power Pump	Drilling Unit	Number of Boilers	Hp. of Boilers	Boiler Pressure lb./sq. in.	Fuel Used		Water Used bbl./hr.
										Gas cu. ft./hr.	Oil bbl./hr.	
Chandler, Okla...	9	4½	210	550	Yes	No	2	125	250	8,020	.....	.....
Fitts Pool, Okla..	12¼	6⅝	200	545	Yes	Yes	3	100	250	15,344	.....	27
Fitts Pool, Okla..	8¾	4½	165	575	Yes	Yes	3	100	250	11,960	.....	15.7
Fitts Pool, Okla..	11	6⅝	200	555	Yes	Yes	1	125	350	13,330	.....	19
Big Hill, Texas ..	12¼	4½	104	590	Yes	No	2	100	300	.....	2.4	.....

Summary

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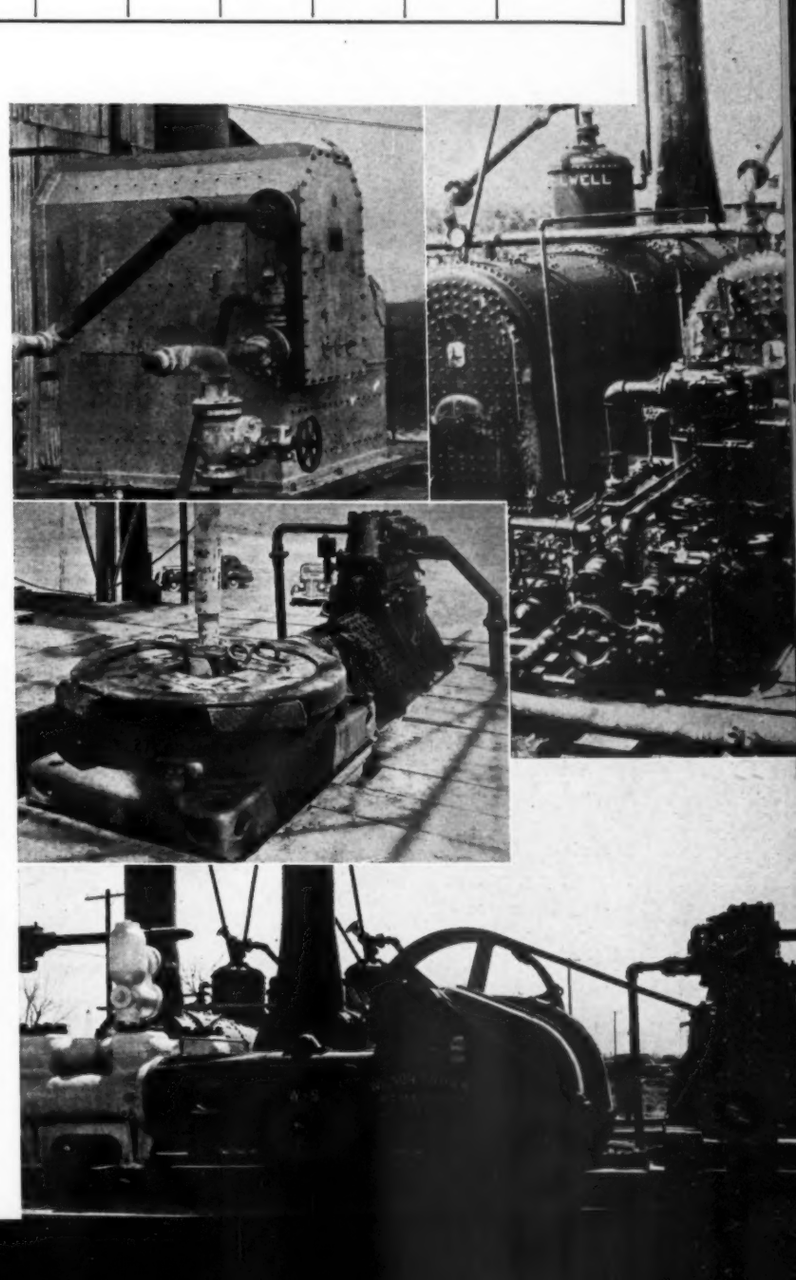
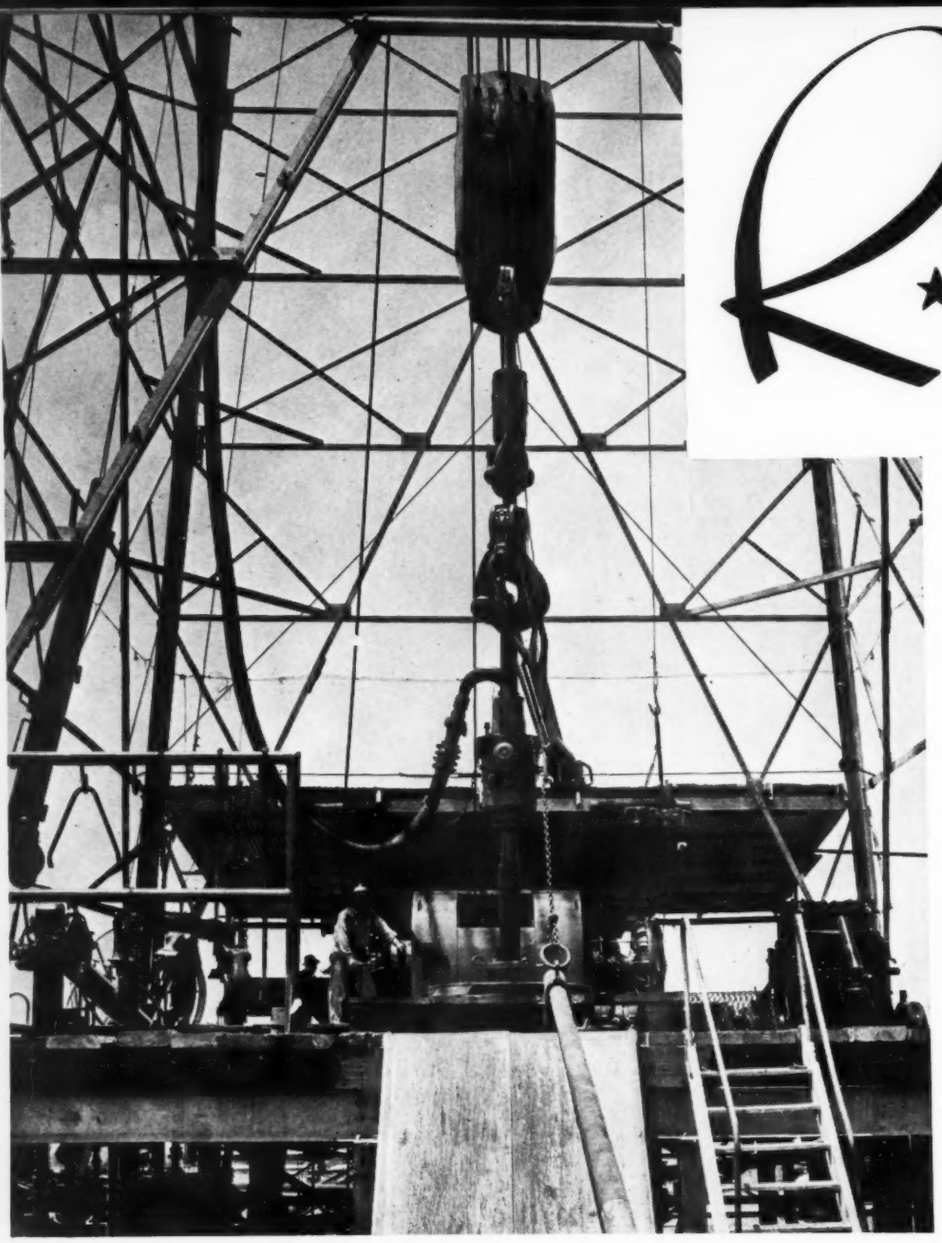
—Modern Power Plant for Steam Drilling Rig



IT is evident from the foregoing discussions that "Oilwell" steam-saving equipment makes possible the use of a much smaller boiler plant. How great are the possibilities for economies to be derived are shown in the table on this page. Attention is called to the consumption of fuel and boiler feed-water.

"Oilwell" steam-saving equipment reduces fuel and water consumption without sacrificing mobility, rigging-up time, or flexibility and speed of drilling. It costs no more—either initially or for maintenance. These are actual field results taken from drilling rigs in normal operation and include all minor losses and wastage due to leaks, heating the "dog house," blow-downs, etc. The results in no instance cover less than several days' operation and in some instances the entire time consumed in drilling the well. All are average figures.

Rotary Drilling Equipment



Gulf Coast deep test being drilled with "Oilwell" heavy-duty rotary drilling equipment

"OILWELL'S" continuous contact with the drilling of oil wells has provided the background of experience necessary for designing and manufacturing drilling machinery that successfully meets the constantly changing requirements. Until a few years ago the principal demand of the drilling trade was for increasingly stronger and heavier equipment without regard for efficiency, weight, or the refinements of good engineering. Lately there has been a complete reversal in this respect and the gross extravagance of the "good old days" has been replaced by accurate cost accounting, a demand for carefully-designed equipment, and a vast improvement in the methods of caring for equipment by the operators. These changes have led to startling reductions in drilling costs. Such is the natural result of applying sound economic principles to the management of drilling operations.

It is the manufacturer's responsibility to his customers to bend every effort toward reduction of costs; it is his ultimate goal; it is the basis on which the industry is enabled to make sound progress. With respect to methods and equipment, the drilling of wells for many years was carried on largely by men who had grown up in the work and were eminently qualified by experience, but in the rush of things that usually accompanies financial recovery, they had little time for the finer points of engineering and management. The nation-wide depression of the early 1930's did much to awaken the drilling industry to its need for the same type of careful cost analysis and management found so necessary and in use for years in many other industries. Manufacturers of drilling tools and equipment, with their engineering and research staffs, until recently have been prevented from being of the greatest possible assistance to the drilling industry because of the traditions of which drillers were victims and by the reluctance of the field men to "take up new ideas."

Times have changed. The drilling industry has become vitally interested in improving efficiency and performance and in lowering costs of "making hole." Manufacturers can take pride in pointing to their contributions in making this new order of things possible. "Oilwell" has been particularly prolific in developing new and improved products and finds it stimulating that drilling operators have become receptive to adopting equipment and tools of advanced design. At this juncture "Oilwell" wishes to express its sincere appreciation of the help and coöperation it has received from its valued customers in analyzing the requirements from an operating standpoint and in making helpful suggestions. After all, the manufacturer does not use the equipment himself and must obtain his understanding of its application to the work from the user.

"Oilwell" designs and builds in its own plants a complete line and range of sizes of all the major items of equipment used for drilling with rotary rigs as follows:

Oil Country Boilers.
Boiler Feed Pumps.
Feedwater Heater-Pump Units.
Steam Engines—Horizontal and Vertical.
Slush Pumps—Steam and Power.
Rotaries—Flat-Top Oilbath—Make-and-Break.
Hoists—Unitized, 2-shaft and 3-shaft.
Traveling Blocks—Streamlined.
Crown Blocks—Center-Pin Type.
Swivels—Oilbath.
Drilling Units (Direct Steam-Engine-Driven Rotary).
Portable Double Steam-Engine Drive.
Feed Control ("Oilwell" Brantly Hydraulic).

Steam Engines
Horizontal Twin-Cylinder Piston-Valve Type

THE "Oilwell" 12-in. by 12-in. Horizontal Twin-Cylinder Piston-Valve Steam Engine has been developed especially to fill the need for a horizontal steam drilling engine that is efficient in the true sense of the word—an engine that will provide ample power, speed, and acceleration for the fastest and deepest drilling operations at low operating expense and low upkeep. Every detail of design and construction has been worked out carefully to meet the severest field requirements, and the performance of the engine has been thoroughly tested and proved in actual oil field service.

The steam ports and passages and the inside-admission type balanced piston valves have been designed specially to provide ample power, rapid acceleration, high speed, and efficiency. All working parts are constructed to withstand the stresses and strains of the heavy loads resulting from the high steam pressures (350 lb. per sq. in) now used in the oil field.

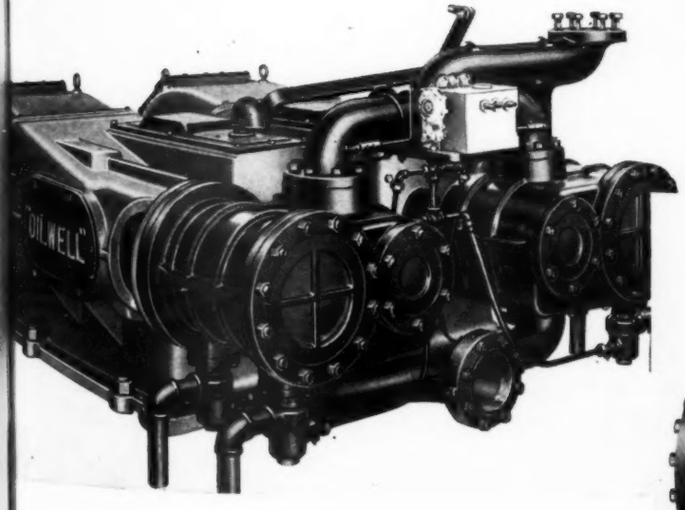
The use of double-row heavy-duty tapered roller bearings on the crankshaft and crank pins, combined with an efficient lubricating system, results in negligible frictional resistance when accelerating the engine. The combination of a rigid bed (frame), properly-balanced moving parts, and balanced piston valves makes it possible to reverse the rotation of the crank-shaft quickly and easily under full steam without the use of a kicker.

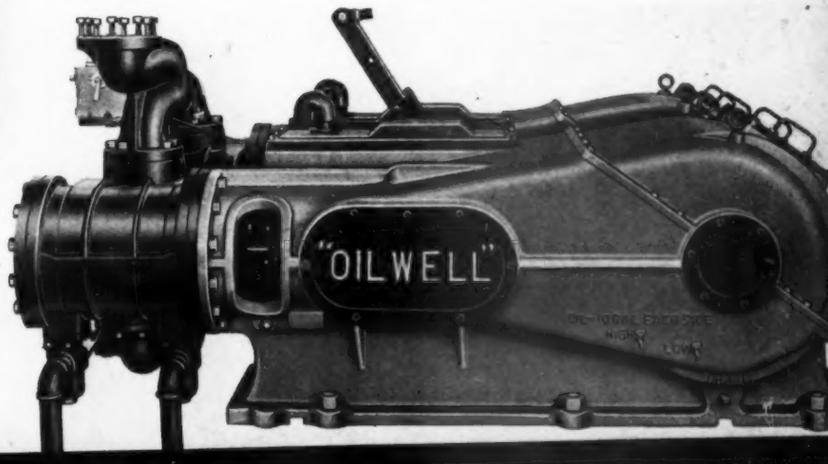
To use balanced piston valves (the most efficient steam valve for oilfield steam drilling engines), an outlet must be provided for the water that collects in the steam chests and cylinders. This "Oilwell" engine is equipped with automatic water-relief valves of fool-proof construction that eliminate this water trouble, which frequently results in broken cylinder heads, crank-shafts, and other parts. These automatic water-relief valves are exclusively an "Oilwell" development for drilling engines.

A 12-in. by 12-in. twin engine, designed and constructed for 350 lb. per sq. in. boiler pressure, develops a maximum torque of 21,000 ft-lb., assuming 300 lb. per sq. in. pressure at the pistons. With the engine operating at 250 r.p.m. and an overall maximum speed reduction to the drum shaft of 7 to 1 the torque at the drum shaft for hoisting in low-low is approximately 110,000 ft-lb., allowing for all losses. This is equivalent to a single-line pull of 73,500 lb. on a 36-in. line-spooling diameter. From this it is apparent that a 12-in. by 12-in. engine has ample capacity to handle much greater loads than is permissible with the wire lines in use today. For this reason "Oilwell" engineers do not recommend engines larger than 12 in. by 12 in. for even the deepest drilling, especially as high steam pressure is becoming quite common.

"Oilwell" also manufactures an 11-in. by 11-in. light-duty twin slide-valve babbitt-bearing type of drilling engine for shallow work where this lower-priced machine, suitable only for lower steam pressures, is adequate. Light-duty single-cylinder steam engines for cable-tool drilling are also made by "Oilwell."

The 12-in. by 12-in. Horizontal Twin Engine is described and illustrated in "Oilwell" Bulletin No. 134.





Two views of the "Oilwell" 12-in. by 12-in. Horizontal Twin-Cylinder Piston-Valve Steam Engine, equipped with automatic water-relief valves of fool-proof construction—an exclusive "Oilwell" development for drilling engines

"Oilwell" No. 12 Vertical Steam Engine undergoing a regular running test at the factory before shipment

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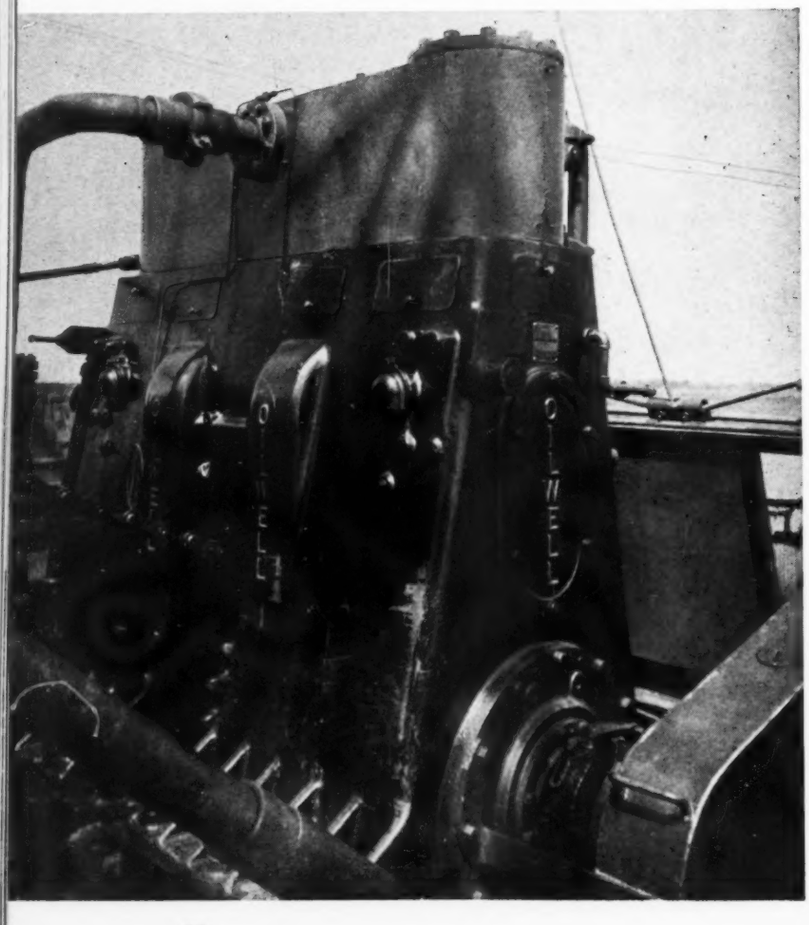
75 years of progress

Vertical Steam Engines 12×12 inch Twin Cylinde

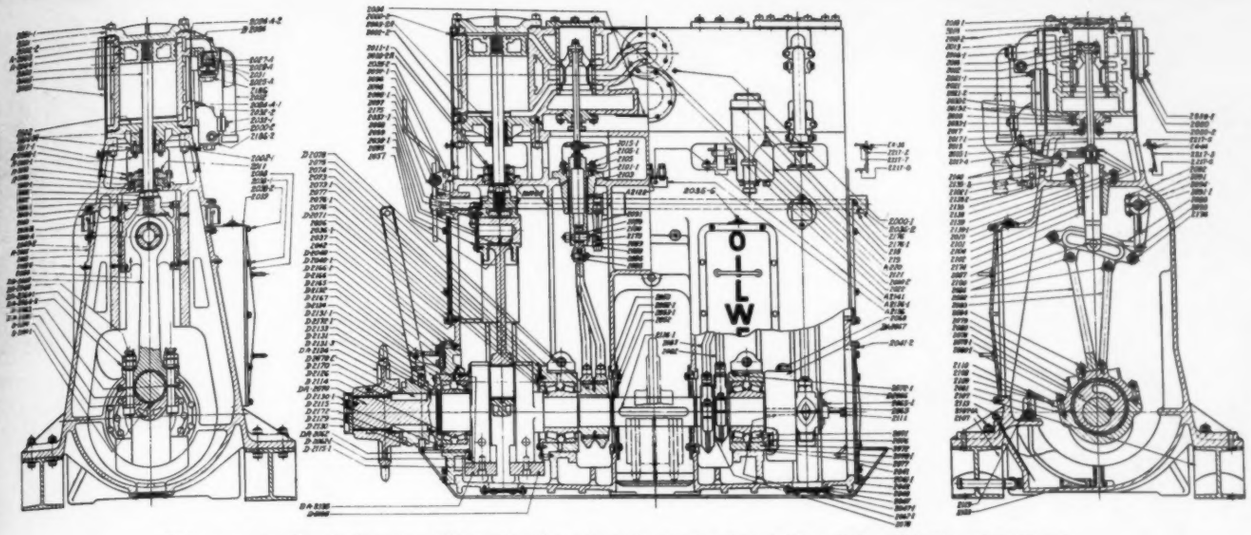


SOME years ago "Oilwell" engineers decided to build a vertical twin engine—size 12 in. by 12 in.—for oilfield service. This was a rather radical step to take in view of the universal use of the horizontal type up to that time, but it was thought that the advantages to be gained soon would be recognized and result in improved operation and economy. Into this vertical design were built all the engineering and structural refinements that ordinarily are found only in the highest quality of stationary engines used in power plants.

In the vertical type engine there is reduced wear of cylinders, pistons and valves, and valve bushings, because the moving parts are not riding with their entire weight on the co-acting stationary parts as in the horizontal type. The unbalanced forces act perpendicularly to the foundation, thereby eliminating vibration of the derrick that is usually present with the horizontal engine. In the "Oilwell" vertical design particular attention is paid to the design of the valve gear and the proportioning of the steam ports and clearances to provide the utmost in flexibility, economy, and power.

The "Oilwell" 12-in. by 12-in. Vertical Twin Steam Engine is equipped with a hand-adjustable cut-off control of the remote type placed at the driller's position, so that the speed of the rotary table and the power fed to it can be

The engine illustrated on the left is the "Oilwell" No. 12-D with clutch-sprocket at one end of the frame providing a convenient sand reel drive—an especially popular hook-up in many of the Gulf Coast fields. Such a hook-up is shown in the illustration at the right.



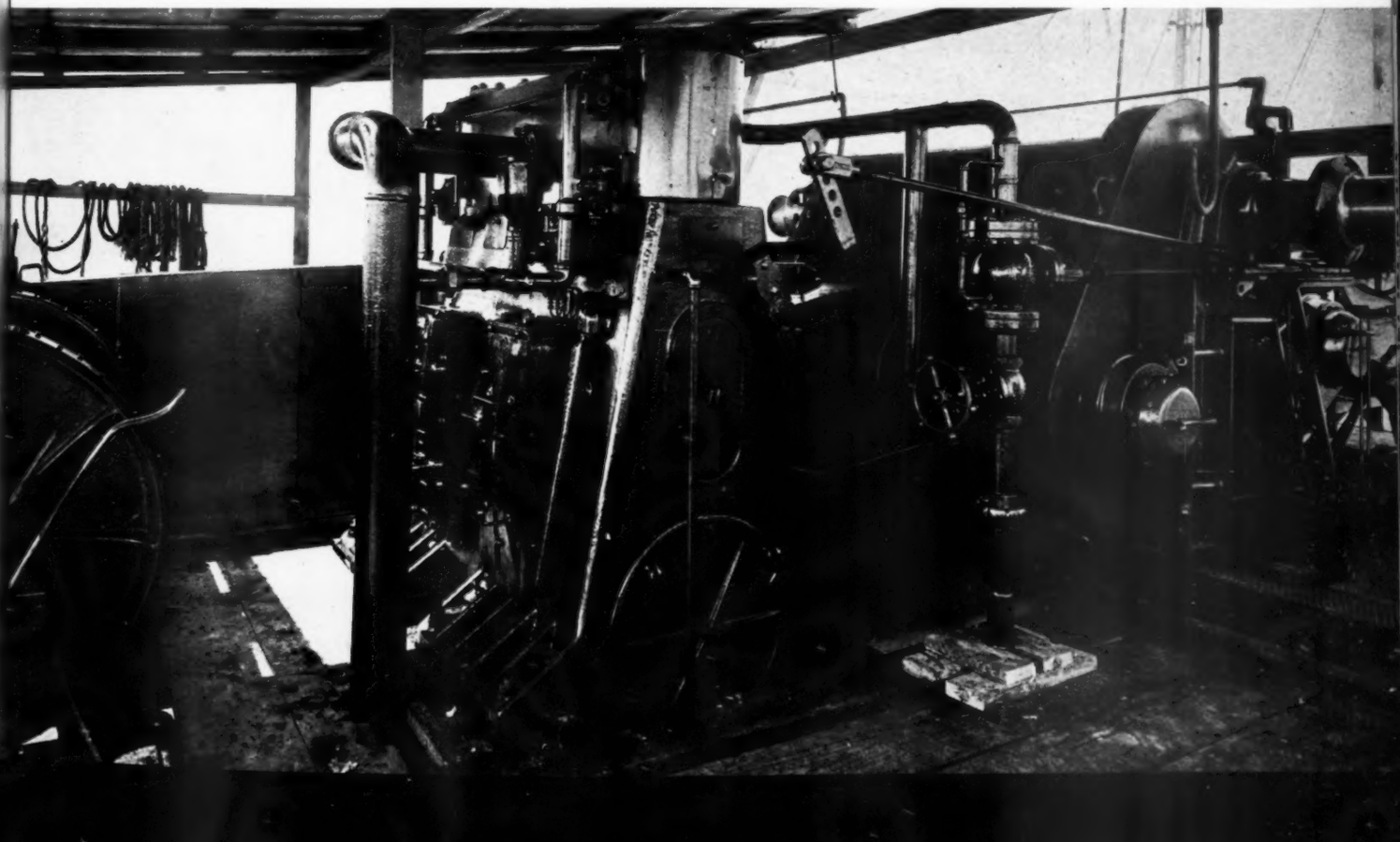
This cross-sectional drawing illustrates the general construction of the "Oilwell" No. 12-D (Dual Type) Vertical Twin-Cylinder Steam Engine

controlled economically, while drilling, by proper cut-off adjustment rather than by throttling alone. The engine is made with two types of crank-shaft construction; namely, the center drive in which the power take-off is at the center of the crankshaft length, as in the horizontal engine, and the dual drive in which the crank-shaft extends through one end of the frame and provides two points for power take-off—one at the center and one at the shaft extension. The dual drive has been employed to good advantage for driving direct to wire-line core-barrel reel and also for power-slush-pump drive while simultaneously driving the rotary through the hoist by means of the center sprocket.

The "Oilwell" 12-in. by 12-in. Vertical Steam Engine is constructed for a working steam pressure of 350 lb. per sq. in. and the capacity of its bearings, size of shaft, etc., are appreciably larger than the horizontal engine. Being heavier and somewhat higher priced it is usually employed with only the heaviest drilling equipment. It has been in successful operation for several years in the deepest fields with many of the largest companies and prominent drilling contractors. It has been used on many rigs at Kettleman Hills, California, and various other fields whose drilling conditions are severe. It requires less floor space in the engine house, is easy to move, and is supplied complete with lubricator, automatic water-relief valves, etc., as factory equipment.

As already pointed out, the 12-in. by 12-in. size is amply large for the deepest drilling. In fact, the "Oilwell" Vertical has even better steam distribution and valve gear, resulting in a slightly greater mean effective pressure at the pistons for any given steam pressure, than does the horizontal. The engine is completely enclosed and weatherproof, and is of roller-bearing construction, with oilbath and forced-feed lubrication, thus assuring long life and low maintenance expense. One of these engines has a record of two years continuous service at Kettleman Hills drilling without repair or replacement of parts. The first of these engines operated for three years in the Gulf Coast before needing overhauling and during that time drilled approximately *40 miles* of hole. Records of this kind account for its rapidly increasing popularity, evidence of which is the placing of repeat orders by satisfied users after drilling many thousands of feet of hole with their first vertical engine.

No. 12 and No. 12-D engines are described in "Oilwell" Bulletin No. 132.



Vertical Steam Engine

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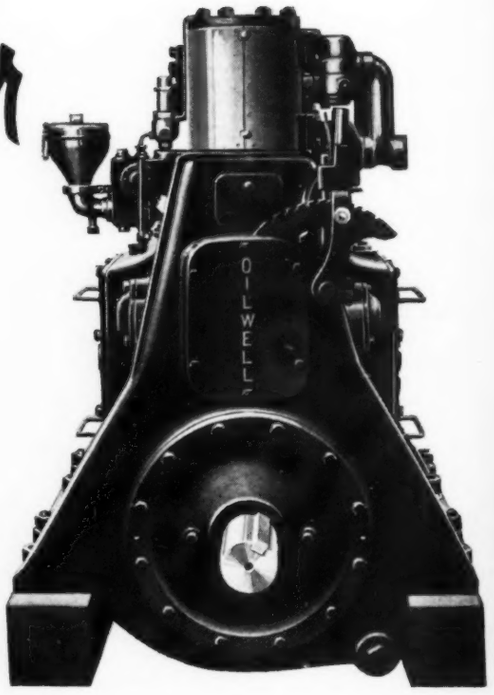
7¾ × 7 inch Twin Cylinder

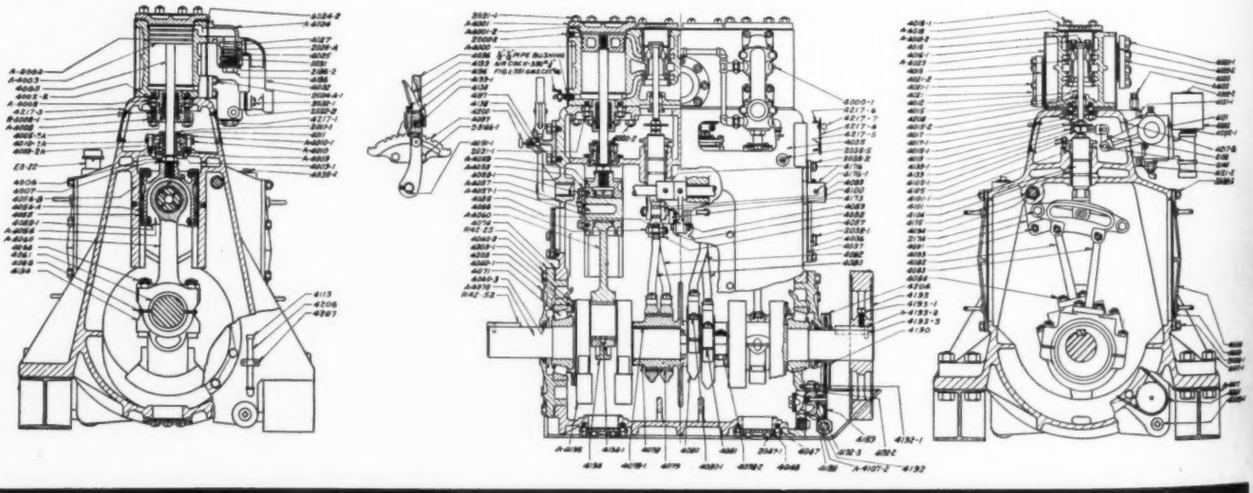


THE outstanding success of the "Oilwell" 12-in. by 12-in. Vertical Steam Engine for oil field use influenced "Oilwell" to design and build a smaller size (7¾ in. by 7 in.) that would have a wide application on a drilling rig. Up to the present, three separate applications of this smaller engine have been made successfully and more than 100 engines put into service over a period of about two years.

Like the 12-in. by 12-in. "Dual" type, this engine has provision for two points of power take-off. The shaft is extended through both ends of the frame. These equal shaft extensions make the engine entirely symmetrical and provide extreme flexibility in setup and application.

It is equipped with full reverse gear and hand-adjustable cut-off control, making it adaptable for driving hoist, power slush pump, and rotary table. In regard to weight of reciprocating and rotating parts and counterbalance, it is designed especially for continuous high-speed (400 r.p.m. normal) operation. The designers gave particular attention to the valve gear and steam distribution to insure the utmost in steam economy, quick acceleration, and power.

This cross-sectional drawing illustrates the general construction of the "Oilwell" No. 7 Vertical Twin-Cylinder Steam Engine



The engine is compact and of relatively light weight per hp. output. A low center of gravity and a broad base make it easy to handle in the field. Being designed specifically for high-speed operation under heavy loads the materials used in the construction are of the highest grade obtainable so as to provide extreme ruggedness with minimum weight, particularly in the reciprocating parts. This is necessary for proper balancing and results in smooth running.

The crankshaft is mounted on heavy tapered roller bearings of sufficient capacity not only to resist the thrust of the pistons and the inertia forces of the moving parts, but also to withstand the belt or chain pull of the drive. Where the engine is not direct-connected to the driven machine the V-belt drive naturally is to be preferred and is recommended, because the elasticity of this type of drive is beneficial in absorbing shock loads that may be present.

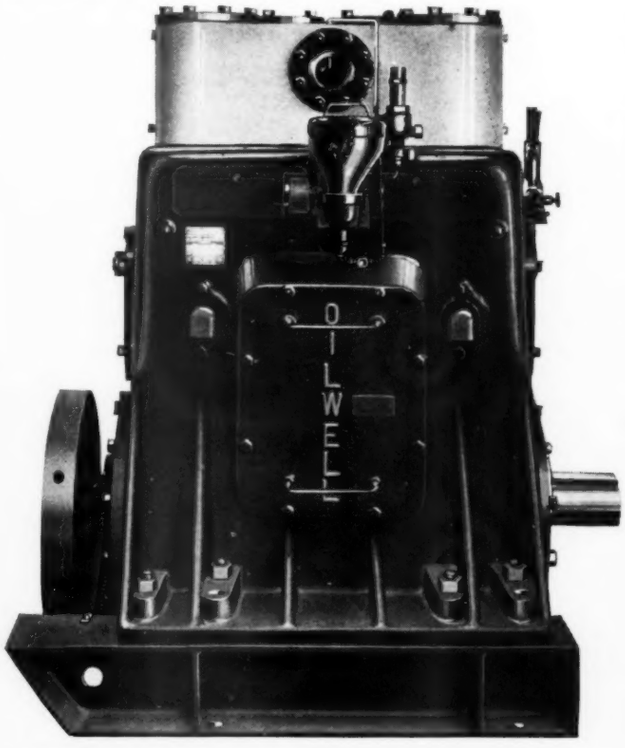
The piston rods are packed against leakage of steam, water, and oil by special all-metallic packing developed particularly for vertical engines. In addition to the normal packing for steam, the steam-packing gland is provided at its lower end with water-scraping rings that remove the condensed steam from the rods and discharge it to one side of the crankcase upper deck whence it drains away. The lower or diaphragm wiper packing has oil-wiping rings in its lower section for removing oil from the piston rod and returning it to the crankcase, as well as upper water-wiper rings for preventing the entrance of water into the crankcase.

A chain-driven oil pump is used on applications where the speed may be slow, but is not necessary where the speed is relatively high, as there is ample splash of oil to lubricate all moving parts. When it is not needed, the chain driving the oil pump may be removed.

The engine is regularly supplied with all accessories, such as forced-feed cylinder lubricator, automatic water-relief valves, etc., as regular factory equipment.

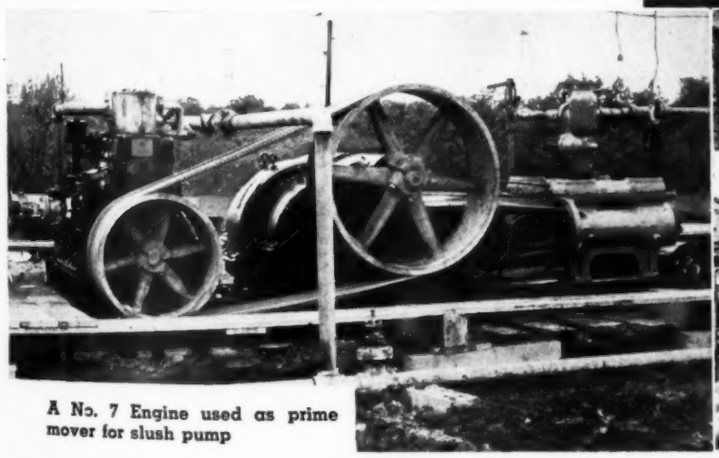
The various applications of this engine are dealt with separately in the following pages.

Detailed information is given in "Oilwell" Bulletin No. 146.

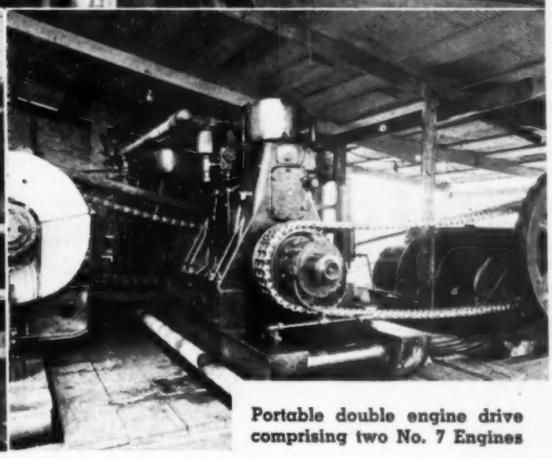


Above: Side view of 7¾-in. by 7-in. Vertical Twin-Cylinder Steam Engine. End view of engine is shown on page at left

A group of 7¾-in. by 7-in. Vertical Steam Engines on assembly floor at factory



A No. 7 Engine used as prime mover for slush pump



Portable double engine drive comprising two No. 7 Engines

Slush Pumps for Rotary Drilling

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EARLY in 1926 the Wilson-Snyder Manufacturing Corporation placed its first slush pumps in the oil fields. Though this type of pump application was new to the organization, entry into the field of slush-pump manufacture was warranted by its more than 50 years of experience in the design and construction of reciprocating pumps for all kinds of hydraulic service. Wilson-Snyder began business in 1874 and in 1878 took up the manufacture of pumps for steel-mill service, at a time when the steel industry was in its infancy, and grew with that industry as its demand for heavy-duty hydraulic machinery increased. Shortly after the world war Wilson-Snyder entered the field of oil pipe line pumping and constructed many pipe line pumps for use at home and abroad. In the early twenties it also developed and pioneered many of the first high-pressure high-temperature refinery pumps demanded by the "cracking" processes, which then were in their earliest stages of development. With this extensive background Wilson-Snyder was singularly well-fitted to meet the problem of providing the drilling industry with pumps of the proper design and construction for handling abrasive and viscous mud fluid at high pressures and in large volume. Evidence of how well

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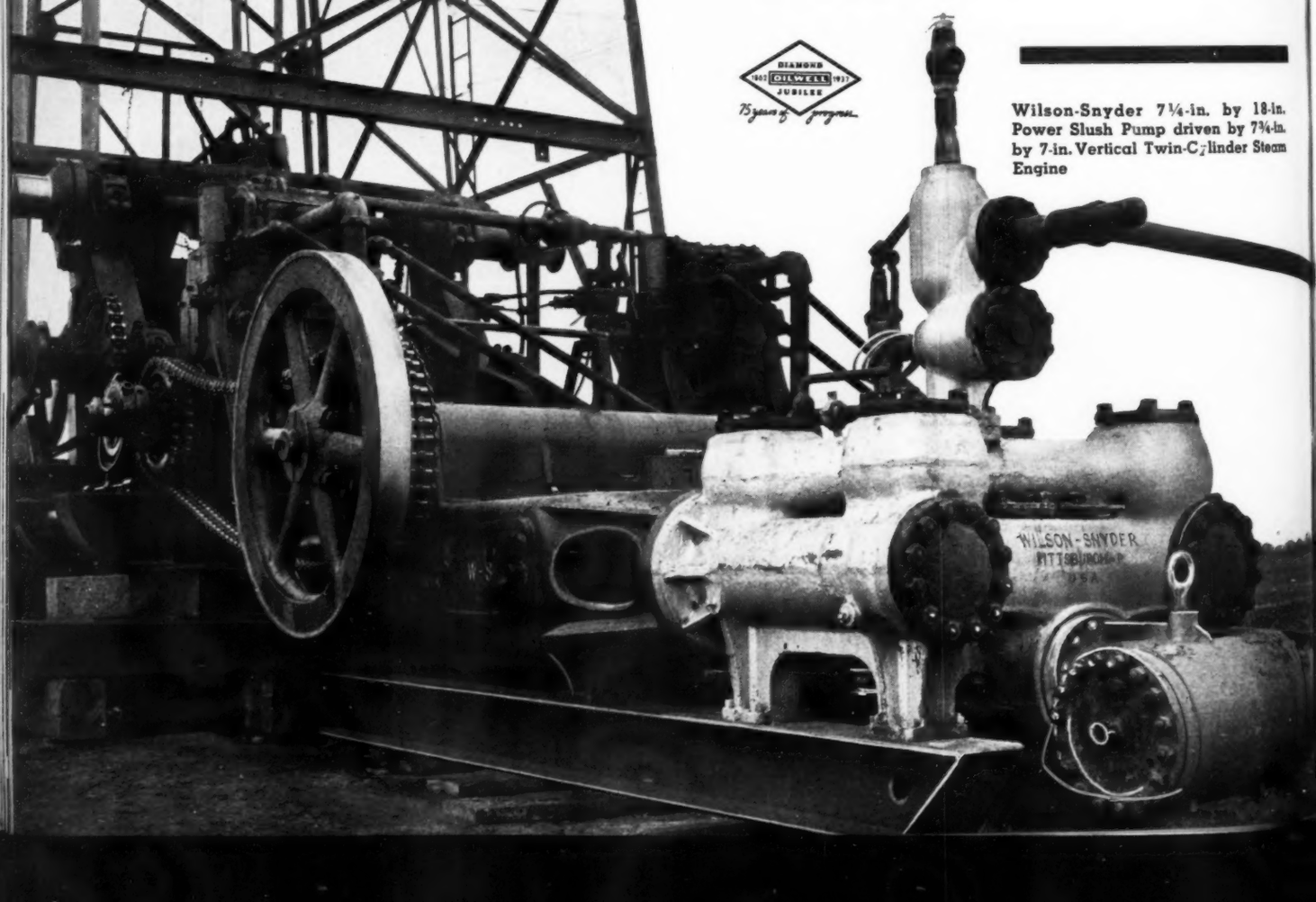
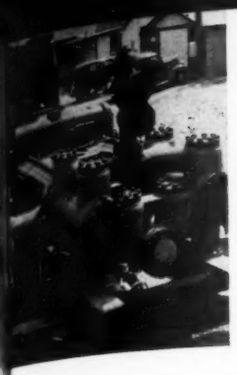


Wilson-Snyder 7¼-in. by 18-in. Power Slush Pump driven by 7¾-in. by 7-in. Vertical Twin-Cylinder Steam Engine



this problem has been met is the fact that Wilson-Snyder slush pumps today are well and favorably known in every oil field in the world where there is rotary drilling.

In 1929 Wilson-Snyder became a subsidiary of "Oilwell" and since that time all slush pumps carrying the "Oilwell" name have been designed by the engineers who design Wilson-Snyder pumps and have been manufactured in the Wilson-Snyder plant. Soon after Wilson Snyder became affiliated with "Oilwell" a full range of sizes was developed so that "Oilwell" might have available a complete line of slush pumps for marketing throughout the oil fields of the world. The additional sizes developed carry the "Oilwell" name and with the exception of the Wilson Supply Company, which has exclusive distribution on the Gulf Coast for pumps bearing the Wilson-Snyder name, "Oilwell" is the sole sales outlet for the entire line throughout the world.

Many improved details of construction have been provided, each resulting in lower cost per foot of hole drilled. These improvements may be grouped as follows:

FLUID ENDS AND FLUID-END PARTS FOR BOTH STEAM AND POWER PUMPS

1. One-piece Open-type Direct-flow Fluid End with Combination Suction

In this improved fluid-end design all the various component parts are cylindrical in cross-section, providing the greatest strength to resist high internal working pressures. There are no internal walls subjected to high differential pressures through which leakage may go unobserved until irreparable damage has occurred. All pressure sections are exposed and any leak or failure of the casting is immediately perceptible and accessible for repairs.

Wilson-Snyder engineers developed this greatly improved design more than ten years ago to replace the then used indirect-flow internal-wall type of single-casting fluid end and the two-piece fluid end, the latter being particularly objectionable because of the large number of gasketed joints required and the difficulty of assuring bore alignment. At the present time practically all makes of slush pumps are of the type pioneered by "Oilwell" and Wilson-Snyder.

2. Combination Suction Arrangement

Operators vary in their methods of setting and connecting slush pumps with respect to the slush pit and the rig. In order to meet all well-location conditions "Oilwell" developed the combination or side-and-end suction type of fluid end. This construction reduces to a minimum the number of elbows required in the suction line no matter how the pumps are placed with regard to the pits. For the best pump operation it is vitally important that the suction line be the shortest possible and that it be of large diameter and free from air pockets, especially when viscous and "gas-cut" mud fluid is being pumped. "Oilwell's" large-size combination suction arrangement incorporates the best possible construction for reducing pump troubles caused by unfavorable suction conditions. The combination suction arrangement also has definite advantages when it is desired to compound the pumps.

3. Suction Strainer for Slush Pumps

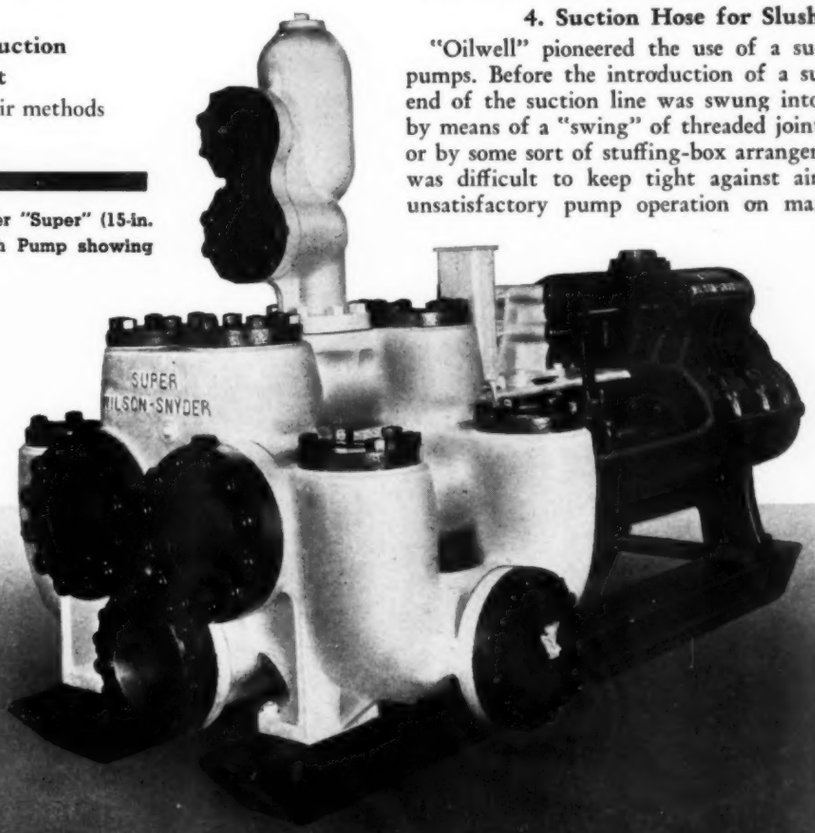
In most drilling operations the slush-pump suction draws from an open pit dug in the ground. With such an arrangement twigs, stones, and other foreign particles of large size inevitably become entrained in the mud fluid and are drawn into the pump through the suction pipe. These do great damage to the fluid valves, liners, and pistons, causing excessive replacement of parts. To overcome this condition and reduce operating costs "Oilwell" designed two types of strainers—angle and straight—each type being available in several sizes. Each type of strainer is readily attached directly to the pump suction flange and removes the large fragments of foreign matter from the mud fluid before they enter the pump and interfere with the working parts.

The screen in an "Oilwell" strainer is of ample size, the total area of the screen opening being several times larger than that of the pipe. It is attached to a cover that is easily removed for cleaning. The flow of fluid through the strainer is such that all fragments of foreign material are deposited on the inside of the screen and therefore are removed with the screen, making the cleaning operation easy and thorough.

Careful attention has been given to the elimination of air pockets in the strainer body. No operator can afford to operate his slush pumps without the "Oilwell" suction strainer, which costs very little initially, has no maintenance expense, and saves in a short time many times its cost in increased service life of valves, pistons, and liners.

4. Suction Hose for Slush Pumps

"Oilwell" pioneered the use of a suction hose for slush pumps. Before the introduction of a suction hose the inlet end of the suction line was swung into and out of the pit by means of a "swing" of threaded joints in the suction line or by some sort of stuffing-box arrangement. Either of these was difficult to keep tight against air leakage and much unsatisfactory pump operation on many drilling rigs has



Fluid end of Wilson-Snyder "Super" (15-in. by 7¾-in. by 20-in.) Slush Pump showing combination suction

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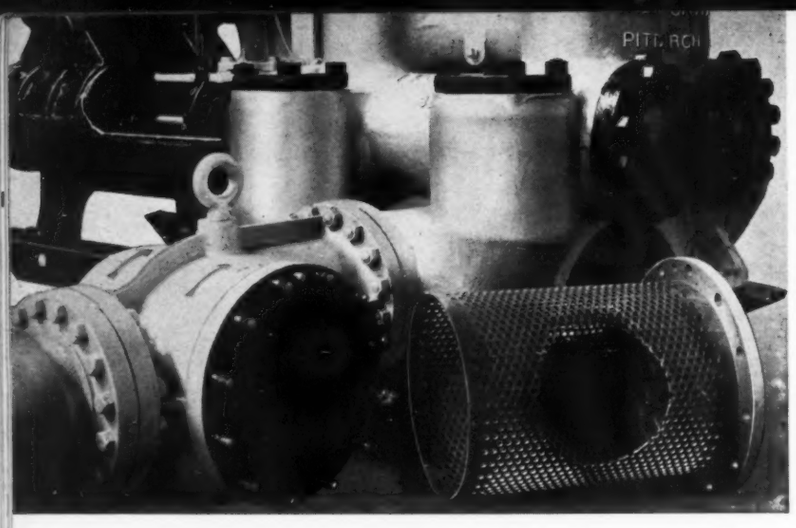


Suction strainer prevents slush pit debris from entering pump and hanging up the fluid valves. Removal of the strainer cage automatically removes the collected debris

been traced to this relatively minor detail. The suction hose eliminates leakage and permits movement of the suction pipe as desired. Being flexible, it serves to absorb the shock of surging fluid that is always present in a reciprocating pump operating at high speeds and thus results in smoother and quieter operation. Practically all operators now use the suction hose, distinctly an "Oilwell" development.

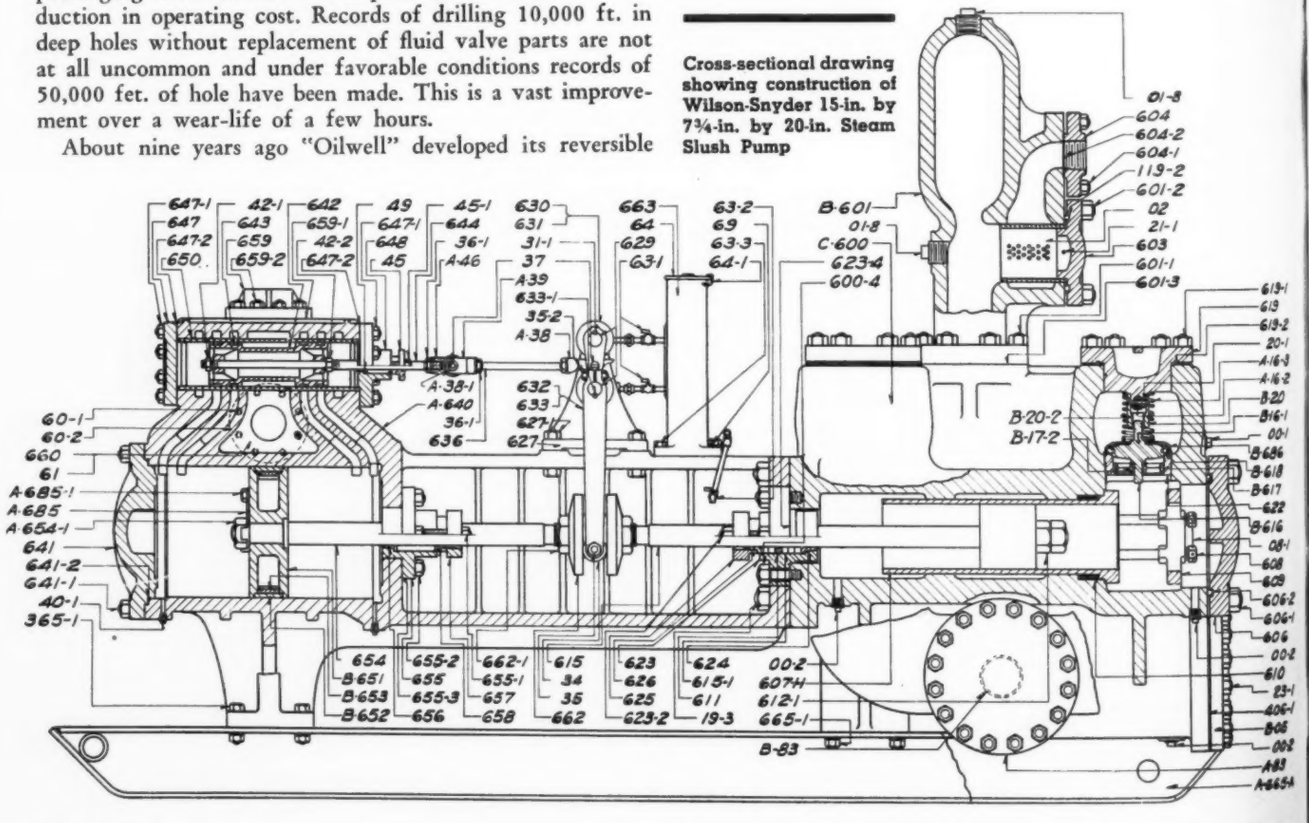
5. Slush Pump Valves and Seats

Experienced drillers of today need not be reminded of the great advance that has been made during the last ten years in extending the wear-life of slush-pump valves. In the old days when the valves were of iron or steel with rubber or balata inserts it was not at all unusual to require a change of inserts each tour. The insert in this old construction was compelled to withstand not only the entire load and hammer blow of the valve on the seat, but it also had to seal tightly against the abrasive fluid. In the new type of valve the load and hammer blow are taken metal to metal and the insert acts only as a cushion and sealing member. This results in prolonging the wear-life of all parts and a substantial reduction in operating cost. Records of drilling 10,000 ft. in deep holes without replacement of fluid valve parts are not at all uncommon and under favorable conditions records of 50,000 fet. of hole have been made. This is a vast improvement over a wear-life of a few hours.

About nine years ago "Oilwell" developed its reversible fluid valve and its valve seat with the renewable seat guide. This design has stood the test of time so well that parts now used in new pumps are interchangeable with those made nine years ago. The "Oilwell" valve-service design also includes the rubber bumper in the valve cap to absorb the shock from the upper valve pin when the valve opens. A further improvement of recent date includes the fitting of renewable rubber bushings to the upper and lower guides so that metal-to-metal contact is replaced by rubber-to-metal contact, giving much greater wear-life of both valve stem and valve guide when pumping mud fluid.

It is recognized that despite all the improvements that have been made, one of the largest items of operating cost still is that of valve-part replacements. Pump manufacturers are continually striving by improved design and material to reduce this element of cost. Certain specialty manufacturers also have entered the field who supply valve parts of their own design for various makes of pumps. These "non-standard" valves may have merits of design and be made of satisfactory material but whether or not they are most suitable for the pumps in which they are used is an important question. As any qualified pump designer knows, correct valve area, valve lift, and valve arrangement largely determine the successful operation of the pump, so it is only reasonable to expect that any pronounced change in the design of the valve-service will affect adversely the operation of the pump. A further source of difficulty in connection with "non-standard" valve parts is the danger of there not being a perfect fit between the tapered outside diameter of the seat and the co-acting tapered opening in the pump chamber. When pump-chamber castings and valve seats are machined in the same plant the tools and gauges used to achieve a perfect fit are checked constantly. This is highly important in preventing improper fit between the parts and cannot be controlled when the co-acting parts are machined by different manufacturers at separate manufacturing plants. It is for this reason that slush pump builders deny—and justly so—any responsibility for pumps using "non-standard" parts

Cross-sectional drawing showing construction of Wilson-Snyder 15-in. by 7¾-in. by 20-in. Steam Slush Pump



not supplied by themselves. The moral is: "use only genuine parts for your slush pumps".

6. Means of Holding and Packing Slush Pump Liners

In the early days of rotary drilling the only type of pump available for handling mud fluid was the common variety of water pump then generally manufactured for pumping clear water at relatively low pressures.

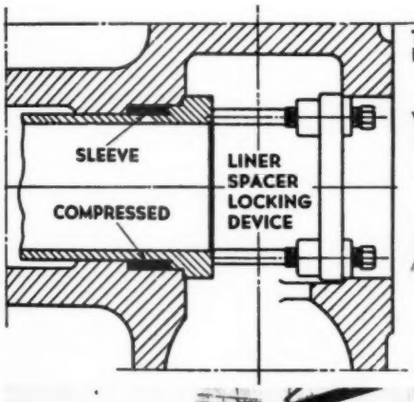
As rotary drilling methods improved, volume and pressure requirements increased. There arose many problems in details of pump construction in order to meet the severe service demands made in handling large volumes of viscous and abrasive mud fluid at high pressures. Not the least of these problems was that of making the pump liners easily removable for replacement and at the same time holding the liner firmly in place and packing tightly between it and the pump-chamber casting in order to prevent leakage between these two parts and consequent destruction of the co-acting surfaces by the cutting action of the mud fluid. For many years it had been the practice—and still is by some manufacturers—to prevent leakage and hold the liner against endwise movement by using set screws in the cylinder head, together with a plain cylinder rubber packing sleeve and, by means of the screws, forcing the flange of the liner against the rubber packing until it fitted tightly in the recess provided. This method has two distinct disadvantages, especially in large pumps operating against high pressures: first, the liner is held against a material that will yield, permitting motion of the liner; and, second, the necessity of tightly packing against leakage the set screws that pass through the cylinder head and at the same time providing for the set screws to turn easily for adjustment.

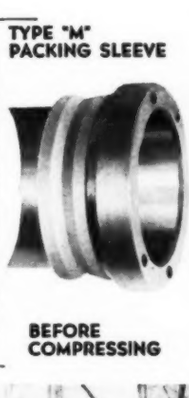
To illustrate the difficulty of holding the liner in place, consider for example: A liner for a 7¾-in. piston has an outside diameter of 8¾ inches. As the piston travels in its stroke the end of the liner toward which it is traveling is under the full discharge pressure and the other end under suction pressure. The net area against which this differential pressure acts is the difference between the internal diameter and external diameter of the liner. In the standard full-size liner of 7¾-in. bore this net area is 13 sq. in., and with a working pressure of 1000 lb. per sq. in. the force against the liner for endwise movement is 13,000 lb. or 6½ tons. Each time the piston reverses direction this force is likewise reversed. Now, considering a reduced-size liner of 6-in. bore in the same pump, the net area is 31.9 sq. inches. With 1000-lb. per sq. in. pressure the force is 31,900 lb. or almost 16 tons. It will be seen that the forces against which the liner must be held to prevent lateral movement are tremendous. If the liner is permitted to move laterally even to a small degree the packing around the liner is disturbed and leakage eventually will result, causing a cut-out pump chamber and liner. Few operators realize the importance of carefully attending to the tightening of liners in slush pumps because they do not appreciate the magnitude of the forces that always are present to cause liner movement.

Attacking this important problem, "Oilwell" engineers devised the internal type of liner-holding device and the type "M" liner packing sleeve, both of which are patented. In this design the inner face of the liner flange is seated firmly metal-to-metal by the four set screws against the machined face of the pump chamber. The type "M" packing sleeve makes this metal-to-metal seating of the liner possible even though there may be slight variations in the dimensions of the packing recess in the pump chamber and those of the rubber sleeve. The sleeve packs by fluid pressure and also by deforming the rubber from its original shape, but not by attempting to compress it. This construction eliminates any possibility of liner movement in a direction away from the cylinder head.

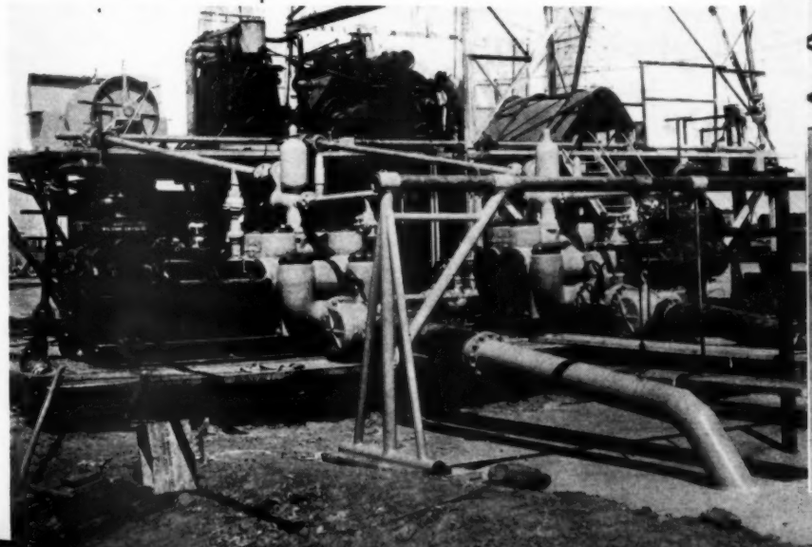
The "Oilwell" internal type of liner-holding device carries the liner set screws entirely within the pump chamber and rests against the pump chamber itself, not against the head. Thus the lateral force against the liner in the direction toward the cylinder head is resisted by the main casting instead of the head itself, which already is severely stressed from the high working pressure alone. The elimination of the set screws through the head permits stronger head-construction with lighter weight (See cross-sectional drawing below).

With the "Oilwell" internal type of liner-holding device the pistons can be changed without disturbing the liner adjustment, as the opening through the device is large enough to allow the full-size piston used in the pump to pass. This cannot be true where set screws through the head are used, as the head makes up with a gasketed joint to the pump

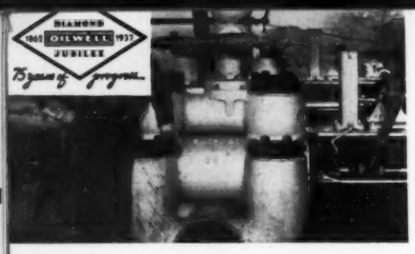




At left: Application of type "M" Liner Packing Sleeve
Below: A Di-Hard Slush Pump Liner.
Note the double reflection of the Di-Hard grilled background on the mirror-finish of the liner. The perfect symmetry of the distorted lines on the mirror-like surface is proof of the extreme accuracy of the finishing operation



At left: Two Wilson-Snyder 15-in. by 7¾-in. by 20-in. steam Slush Pumps on a Gulf Coast rig



chamber and must be tightened additionally each time the joint leaks or the head is removed and replaced. This inevitably disturbs the liner adjustment and often results in broken heads if the set screws are not backed off before the heads are tightened up.

This feature of "Oilwell" slush pumps has stood the test of time and has been in continuous use for about eight years in the larger sizes of pumps operating against the highest pressures.

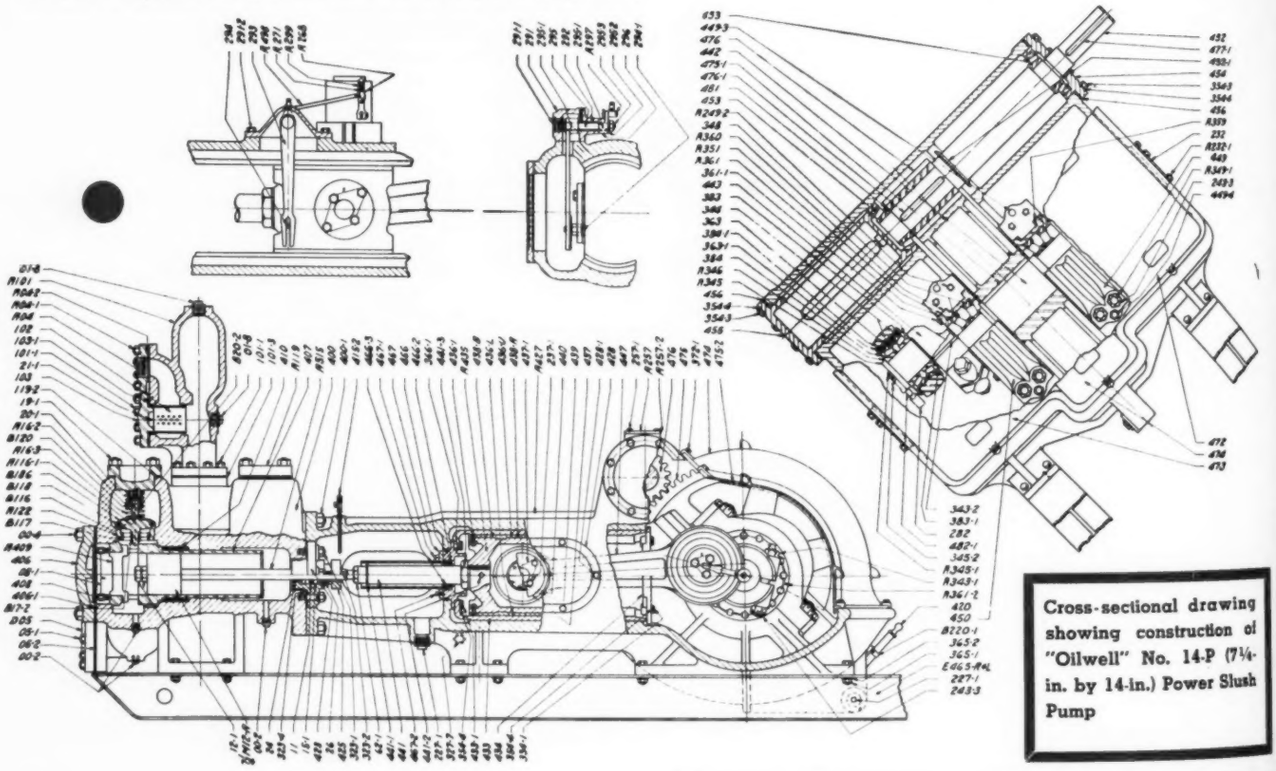
7. "Oilwell" Di-Hard Slush Pump Liners

The Di-Hard Slush Pump Liner probably represents the most important development in recent years contributing toward reduced pump-operating costs. The product consists of a steel shell into which is bonded a lining of a very hard alloy, a product discovered and developed by the Industrial Research Laboratories of Los Angeles, California. This alloy, in addition to having a hardness greater than 600 Brinell, has a pronounced resistance to abrasion compared with other metals of similar hardness and possesses a notably low coefficient of friction. These outstanding characteristics produce remarkable results in slush-pump liner service and reduced slush-pump piston wear. Several thousands of "Oilwell" Di-Hard Slush Pump Liners placed in service during the past three years have established service records that, in general, show that their useful life is approximately five times as long as that of the best heat-treated liners formerly used and the consumption of pistons is approximately only half as great. The price of the Di-Hard Liner to the user is about twice that of the heat-treated steel liner; so it can be seen that from the standpoint of first cost alone the operator has been greatly benefited, not to mention the reduced shut-down time and piston cost.

The Di-Hard metal itself as well as the methods of producing the finished products are fully protected by Letters Patent and "Oilwell" operates under an exclusive license in supplying to the trade this outstanding item whereby slush-pump operating costs are materially reduced.

8. Material for Slush-Pump Fluid Ends

Through many years of experience, the use of materials of known specification, exhaustive laboratory investigations, and accurate control of foundry practice, "Oilwell" has developed for slush-pump fluid ends a high-test cast iron referred to generally as semi-steel. As strength and hardness in all ferrous metals go hand in hand and the stronger materials are the harder ones, the use of those materials that are of higher physical properties results in high manufacturing costs. "Oilwell" engineers specify, with few exceptions, the use of semi-steel for slush-pump fluid ends for two reasons: first, where large-size intricate castings must be free of defects when tested against high internal hydrostatic pressures, the production of sound castings in semi-steel is much more practical than in cast steel; and second, the semi-steel material by its very nature is more highly resistant to the corrosive and erosive action of the mud fluid used in rotary drilling. In certain cases where unusually high operating pressures may be expected cast steel is, of course, the only material commercially practicable. The larger sizes of slush-pump fluid ends made by "Oilwell" of semi-steel withstand hydrostatic tests of 4000 lb. per sq. in. and there are few conditions encountered where the need for a fluid end of greater strength exists. Steel fluid-end castings will weigh less than semi-steel castings of the same strength and, of course, can be repaired by welding if necessary, which is not generally possible with semi-steel; nevertheless, in most instances it is not felt that the much greater cost of the cast-steel fluid end is justified in the long run. "Oilwell" makes cast-steel fluid ends on special order for steam slush pumps and as standard equipment on its larger sizes of power pumps.



Cross-sectional drawing showing construction of "Oilwell" No. 14-P (7¼-in. by 14-in.) Power Slush Pump

The "Oilwell" No. 20-P (7¾-in. by 20-in.) Power Slush Pump is especially designed for trouble-free service on rigs requiring both maximum circulation and high mud pressure. It is the largest power slush pump now made for oilfield use, being recommended for a maximum input of 415 hp. at 50 r.p.m.

STEAM ENDS FOR SLUSH PUMPS

In 1926 Wilson-Snyder introduced the first direct-acting steam slush pump using the piston-type steam valve. This outstanding advancement made possible the use of high-pressure steam, the use of which is not permissible with valves of the slide or flat-face type. We need only observe steam locomotive design for confirmation of this statement. When steam transportation was in its infancy the steam cylinders of the locomotives were fitted with the "D" slide valve because at that time it was the only type of valve known to the engine designer. The slide valve for steam locomotives was replaced entirely by the piston-valve type some 30 years ago.

The piston valve has several advantages that make its use imperative for modern drilling rigs using high steam pressure (up to 350 lb. per sq. in.). In regard to the steam pressure under which it operates, this valve is fully balanced and requires no more power from the valve gear to move it when 350-lb. pressure is used than when 50-lb. pressure is used. This results in a great reduction in the wear and tear on valve gear parts. The piston valve has made possible smooth and efficient high-capacity operation of even the largest sizes of modern pumps, something that never could have been accomplished with the flat-face slide valve. The flat-face slide valve is incapable of being balanced, so requires power to move it in proportion to the steam pressure under which it operates.

The piston valve is always of the "inside-admission" type, which means that the outer ends of the valve are subjected only to exhaust pressure, thus greatly reducing the difficulty of keeping the valve stems packed.

In the "Oilwell" design the "slip" or "lost motion" is within the steam chest. It is intentionally made rather inaccessible to reduce the danger of errors in adjustment by inexperienced attendants. Once the proper amount of "slip" is determined and the proper setting made there is no need for further attention.

"Oilwell" piston valves are equipped with sealing rings, accurately machined and of uniform tension, that operate in removable one-piece bushings having precision-machined ports of large area. This construction makes possible smooth and efficient high-speed operation of the pump and minimum upkeep expense. It is very important that extreme care and accuracy be used in making the valve parts so that the maximum possible stroke of the pump is obtained without overstroking. The proper cushioning of the reciprocating parts is highly important and depends not only on the design and workmanship of the valve parts but also on the proper placing of the steam and exhaust ports in the cylinder. In a direct-acting duplex steam pump the length of stroke with wide-open throttle at various speeds is determined by these factors in the design and construction. At maximum full-throttle speed the steam pistons must not strike the cylinder heads and at slower speeds the stroke must not be unduly shortened. As the determination of these factors is dependent largely on experience, pump manufacturers who have followed "Oilwell's" lead in using the piston-valve construction for slush pumps have not, because of their limited experience, been fully successful in producing satisfactory pumps of this type.

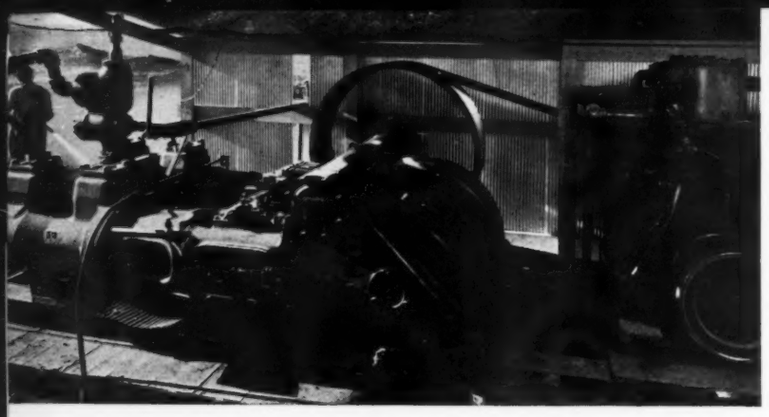
"Oilwell's" one-piece steam-end and cradle construction of well-balanced design and equipped with self-oiling valve gear has been found to be eminently satisfactory in meeting the most severe conditions over a period of more than ten years. In fact, many of these steam ends still are in use that have been in regular drilling service that length of time.

POWER ENDS FOR POWER SLUSH PUMPS

"Oilwell" engineers, having an extensive background in designing and manufacturing heavy-duty duplex power pumps, have pioneered and developed commercially many of the improved design features now used by most power slush-pump builders.

1. Twin Side-Crank Power Frame

When Wilson-Snyder first entered the power slush pump field the power ends of slush pumps were either of the eccentric-drive type or of the twin center-crank type. The earlier manufacturers and designers apparently had felt it was of more importance that the fluid ends of slush pumps be interchangeable on steam and power ends than first to make a really well-designed power end and then provide a fluid end to fit. The result of Wilson-Snyder's experience in building pumps for many kinds of high-pressure service was that its slush-pump power ends were constructed of the twin side-crank type. The fluid ends were of a new type in which the relative positions of the discharge and suction



"Oilwell" 7¼-in. by 14-in. Power Slush Pump driven by a No. 7 Vertical Steam Engine

valves were reversed from that of the steam-pump fluid end. In this type the cylinder bores are on wider centers but the overall width of the pump is not increased. It provides a very short straight crank-shaft to resist distortion. The shaft is firmly mounted in rugged supporting bearings placed in line with the forces developed by the piston load. The main gear operates in a separate compartment from the cranks and connecting rods, thus assuring accessibility of all parts requiring attention and adjustment. The design is symmetrical about the center line. Single-helical gears are used, permitting easy reversal of the "hand" of the drive from one side to the other and the reversal of the gears should the working side of the teeth become excessively worn after years of service. This feature alone has saved operators many dollars in maintenance costs over a period of years.

2. Roller Bearings Throughout

In order to conserve space, reduce weight, increase wear-life and permit heavy-duty operation the "Oilwell" and Wilson-Snyder power ends are fitted with roller bearings throughout in the larger sizes. Heavy-duty tapered roller bearings carry the pinion-shaft, crank-shaft and the crank end of the connecting rods in all sizes and in the larger pumps and the crosshead pins are fitted with the so-called "needle-type" straight roller bearings having a large number of small-diameter rollers. This latter type of bearing is now generally used on very heavy Diesel-engine crosshead pins. In the smaller power ends the crosshead-pin bearings are of the solid bronze-bushing type. The roller bearings all are of excess capacity for carrying the extreme overloads occurring frequently in slush-pump operation.

3. Crosshead and Crosshead-Guide Construction

Prior to the development of "Oilwell's" renewable crosshead-guide construction for power slush pump frames the wearing of the integral guiding surface in the frame was most expensive and annoying. Realizing that in slush-pump service it is frequently impossible to keep the drilling mud and water, and sand and dust from the air, from entering the power frame and causing rapid wear of the crosshead shoes and guides, "Oilwell" engineers pioneered the development of renewable wearing parts at these points. Both the crosshead shoes and crosshead guides are cylindrical in shape and can be replaced easily and at small cost when required. This eliminates the expensive reboring of the frames and refacing of the crossheads and is a construction refinement that few other pump builders have seen fit to adopt, presumably on account of the first cost. This feature merits the increased construction cost, and has been appreciated by "Oilwell" customers for many years.

4. Exclusion of Abrasive Material from Power End

The "Oilwell" power-pump piston-rod extension that connects the fluid piston rod to the crosshead was developed to eliminate the entrance of mud fluid and the water used in washing the fluid end rod from entering the power frame and interfering with the lubrication of the moving parts. This extension is of extra-large diameter and is sealed at the diaphragm through which it operates by metallic packing to prevent the loss of oil from the power end as well as to keep out water and mud. The extension receives the same fluid piston rod that is used in the steam pump of corresponding size, thus increasing the number of interchangeable parts. It also eliminates the necessity of opening the frame doors to change fluid rods.

The various openings in the power frame are provided with weather-proof tight-fitting covers to exclude dust, sand, and water, the entrance of which would cause undue wear of the bearings, gears, etc.

5. Lubrication System

Beginning with first enclosed power ends for slush pumps the lubrication of all working parts was accomplished by the splash system in which the movement of the main gear and the cranks caused the oil to be circulated from the crankcase to all the moving parts and then returned by gravity for recirculation. This system was entirely adequate so far as circulation was concerned but did not take into account the fact that the oil is continually being polluted by water condensing on the inside of the frame or by leakage through the various covers, mud fluid and water from the piston rods, and sand and grit from the air.

In order to overcome this difficulty, which exists in many cases regardless of the measures taken to prevent it, "Oilwell" engineers decided to install a forced-feed system of oiling of the non-circulating type on all power slush-pump frames. In this system a small amount of lubricant is fed continuously to all moving parts, and after passing through the bearings and serving its purpose, it is drained continuously away together with the water and grit that it has picked up in its passage through the power end; thus clean oil in suitable quantities is always supplied to the bearings. At first glance, this may seem to be a wasteful system so far as lubricant is concerned but a closer study will prove that oil in the small quantities required is less costly than new bearings and the loss of time required to install them. The general reliability of power-pump operation has been increased greatly by this system. Many rigs are running today with only one power pump. Operating without a spare slush pump is a practice that would not have been countenanced at all some years ago. The oil draining from the power pump end need not be wasted, for it can be caught in containers and used for other purposes around the rig where the small amount of pollution would not be harmful.

It is not uncommon where splash oiling only is used to find the crankcase full of ice in freezing weather as a result of water having replaced the oil. This results from lack of care on the part of the crew; with the "Oilwell" lubrication system this cannot occur and pump parts last longer. In the "Oilwell" system only the gear and pinion depend on splash-oiling and the gear compartment in the crankcase is entirely separated from the crank compartments, thereby preventing pollution of the gear lubricant.

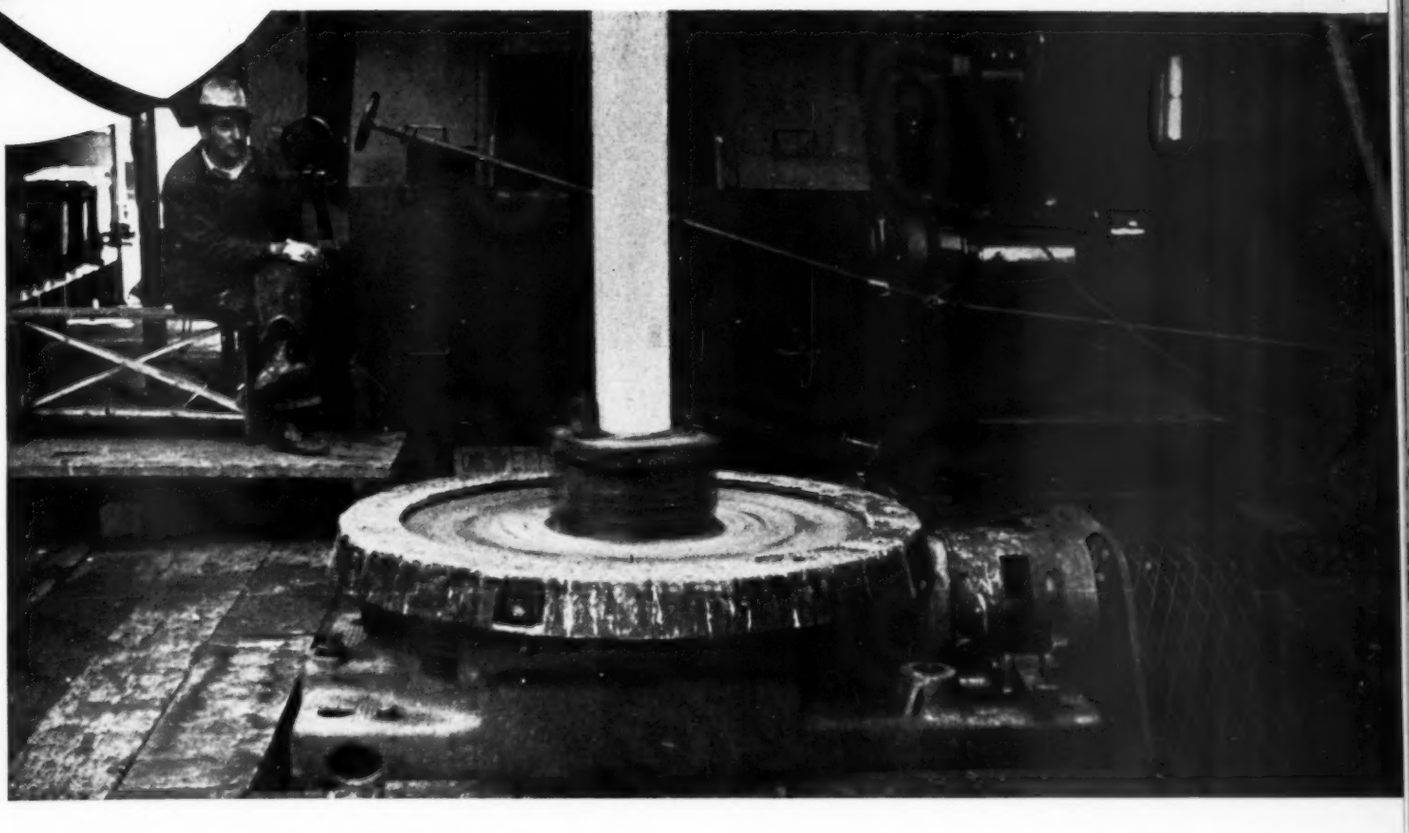
"Oilwell" and Wilson-Snyder slush pumps are furnished in the following sizes:

Power Slush Pumps	Bulletin
No. 20-P (7¾ in. by 20 in.)	168
No. 7-P (7¼ in by 18 in.)	W-94-P
No. 14-P (7¼ in. by 14 in.)	62
No. 16-P (6 in. by 16 in.)	W-90-J
No. 612-P (6 in. by 12 in.)	167
No. 12-P (5 in. by 12 in.)	W-138-K

Steam Slush Pumps	Bulletin
"Super" (15 in. by 7¾ in. by 20 in.) with combination suction	W-159
No. 20 (15 in. by 7¾ in. by 20 in. with end suction)	84
No. 18 (14 in. by 7¼ in. by 18 in. with combination suction)	W-58-R
No. 16 (12 in. by 6 in. by 16 in. with end suction)	W-104-B

Wilson-Snyder No. 12-P Power Slush Pump is an important part of this portable rig

Rotary Machines



"Oilwell" 27½-in. Oilbath Rotary in the Turner Valley Field, Canada

DIAMOND JUBILEE 1902 OILWELL 1937 — 35 years of progress

The rotary method of drilling for oil and gas originated about 1900. A perusal of old "Oilwell" catalogs shows the earliest of these machines and it is stated that the rotary system (then in its infancy) is suitable for soft alluvial sand and quicksand formations. The first rotary machine was made with a 12-in. opening. All parts were of cast iron and the entire machine weighed less than 2000 pounds. It is a far cry from those original rotary machines to the present all-steel oilbath machine with 27½-in. opening through the table, just as it is a far cry from the original rotary-drilled shallow wells of small diameter to present wells 12,000 ft. deep. During the entire development of the hydraulic rotary method, extending over 37 years, "Oilwell" has been in continuous contact with the changing requirements and has been active in providing, step by step, improvements in design, construction, and materials that now are represented by the modern machines so well suited to high speed, deep-hole drilling of the present day. "Oilwell's" present sizes and types include:

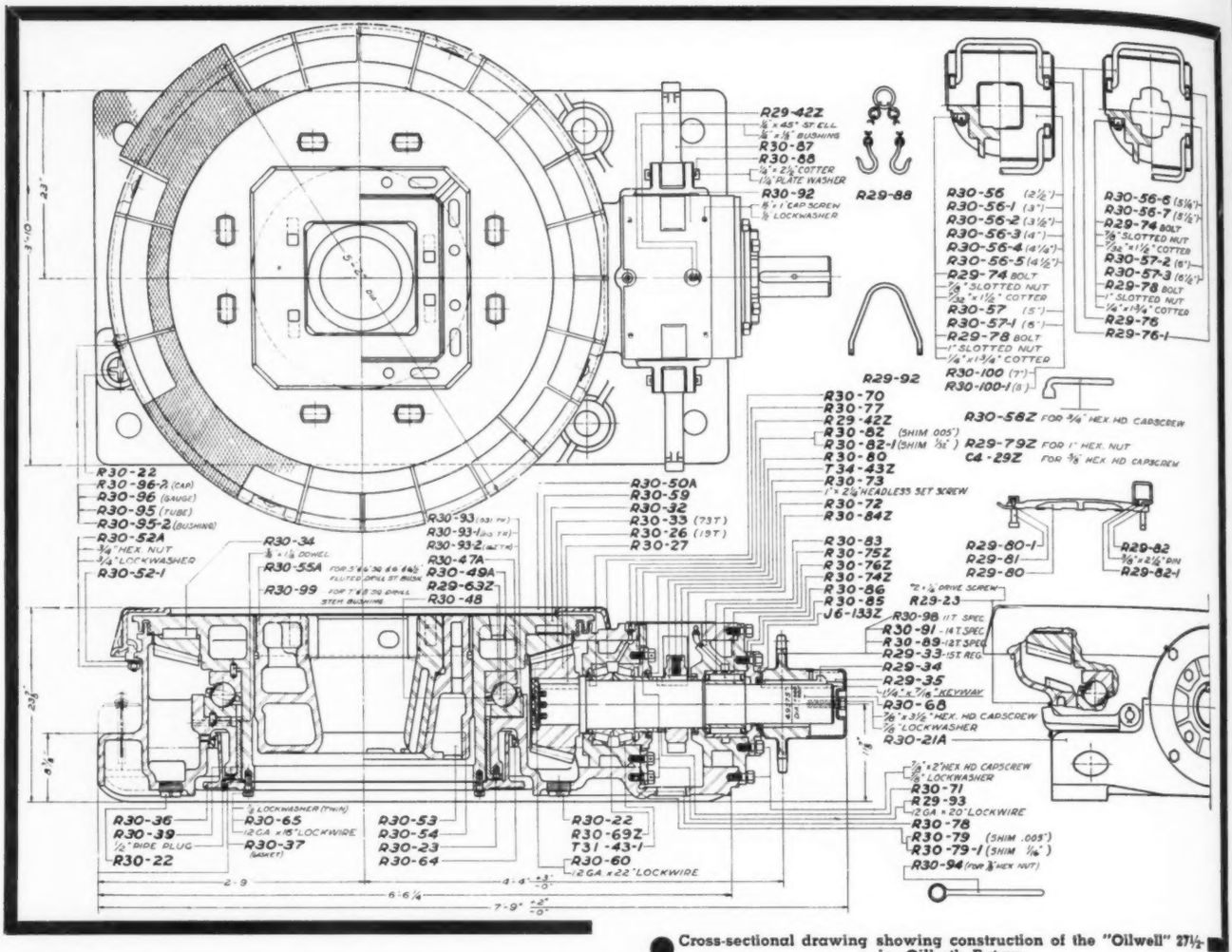
1. 27½-in. Oilbath Flat-Top Non-Make-and-Break
2. 17-in. Oilbath Flat-Top Non-Make-and-Break
3. 26-in. Non-Oilbath Make-and-Break

27½-in. Oilbath Rotary

The present machine is the most advanced in design, construction, and materials that ever has been offered to the drilling industry. The most outstanding single improvement is the use of spiral-bevel gearing in place of straight-bevel gearing. This type of gearing, made of alloy steel and with special surface-hardened teeth, has revolutionized rotary operation, particularly from the standpoint of noise and tooth-wear. The quietness of operation is quite noticeable—quiet-running gears are efficient and long-lasting. "Oilwell" rotaries with this type gearing have been in continuous field service for upwards of two years without the necessity for a single pinion or gear replacement.

Another important improvement in the "Oilwell" 27½-in. Oilbath Rotary is the patented means of returning for recirculation the oil that has passed through the hold-down bearing to the rotary base. This feature makes the rotary of the true oilbath type and eliminates loss of oil from the enclosure, thus reducing operating expense.

The main bearing is of the high-speed ball type, copiously lubricated and designed for high-speed (250 r.p.m.) rotation. Recently it has been determined by certain operators that high rotative speeds, together with relatively light weight on the bit, results in faster drilling and straighter hole through some types of formation. The rotary table, therefore, must be designed and constructed with much greater



● **Cross-sectional drawing showing construction of the "Oilwell" 27½-in. Oilbath Rotary**

refinement and accuracy of workmanship to meet the demands of this new practice. "Oilwell" rotaries have been used by the operators who originated and developed high-speed drilling practice, thus they have been proved capable of rendering this class of service from the beginning.

The hold-down bearing is of the plain bronze type provided with shim adjustment and is an integral part of the bronze skirt bearing. Experience has proved that this hold-down and skirt bearing is of ample capacity to do the work required of it, is easy to lubricate in the "Oilwell" complete oilbath lubricating system, and is simple to install. The cost is considerably less than the ball type of hold-down bearing sometimes used, and the effect of slight errors in fitting parts and adjusting them is much less serious than is the case where both the main bearing and the hold-down bearing are of the high-speed ball type. The construction is more fool-proof, results in lower cost, provides trouble-free operation, and therefore is deemed best adapted to the type of service expected of a high-grade rotary machine.

The base is made of electric cast steel and is of unitary design with integral pinion-shaft bearing supports. This construction in the 27½-in. Rotary provides a rated supportable dead load of 250 tons with negligible deflection of the base, which is strongly reinforced by integral skid sections. The pinion-shaft bearings are carried in two individual supports and lubricated separately. This construction prevents the possibility of polluting the main oilbath by mud fluid that ordinarily might enter by way of the pinion shaft. The pinion shaft is supported in double-tapered roller bearings at the pinion end for axially locating the pinion with respect to the gear and for adjusting for proper running clearance of the

● **The 27½-in. Oilbath Rotary—constructed for the heaviest loads and highest speeds**

● **The smaller 17-in. Oilbath Rotary of the same general construction as the 27½-in. Rotary is popular for portable and light rigs**

bearings. The sprocket end of this shaft is supported in a straight roller bearing having some axial float to prevent any tendency toward binding between the inner and outer bearings. The pinion shaft is extended beyond the outer bearing for overhung sprocket drive and for facilitating the driving of the rotary by a separate prime mover direct-connected to the pinion shaft. The locking device is placed between the bearing housings and is exposed rather than enclosed within a solid housing so that it is readily accessible.

This "Oilwell" Rotary is supplied either with a master bushing or a split spider as the user may desire. The latter permits running large-diameter casing without removing the rotary table.

17-in. Oilbath Rotary

The 17-in. "Oilwell" Oilbath Rotary is practically a counterpart of the 27½-in. machine to a smaller scale. It is built to the same design, the only exception being that the main gear is of the straight-bevel type. The same high-grade materials are used and the workmanship is of the same high standard. The 17-in. machine is used for relatively light work and, therefore, the extra expense of spiral-bevel gears is not warranted.

This size rotary is well adapted for use with portable and combination rigs because of its compactness, all-steel construction, and relatively light weight. It is offered to a low-price market and is of exceptionally high dollar value because of the refinements in construction not usually found in equipment of the lower price ranges, but which, nevertheless, lead to reduced maintenance costs.

26-in. Make-and-Break Rotary

About 20 years ago "Oilwell" introduced to the trade the make-and-break type of rotary machine. This design found favor in many fields because it could be used to "make-up" and "break-out" tool joints while making a round trip. Special trip tongs also were designed to provide for making-up the joints to a predetermined tightness or "set." Reduction of a dangerous hazard and added safety to the crew aided in popularizing this type of rotary. "Oilwell's" make-and-break rotary design is still considered standard for this type.

The introduction of higher table speeds has reduced the use of the make-and-break design to a very few fields. This construction naturally calls for more moving parts that are much more difficult to keep in adjustment and to lubricate at high speeds. It is more expensive, therefore, to maintain under most present-day drilling conditions. The development of the automatic cathead for breaking out tool joints also has been an influencing factor in decreasing the need for the make-and-break machine. Taking these facts into account this type of machine, which, in general, is heavier and considerably more costly, has not warranted development in the full oilbath type but the construction and, particularly, the materials have been improved upon greatly in the "Oilwell" machine in recent years. Cast iron has been replaced by cast steel, cone rollers by ball bearings, and pinion shaft bearing supports have been made integral with the base. The gears are of cut-tooth heat-treated type in place of the cast-tooth type and all these improvements make it feasible to operate at higher speeds than heretofore. The make-and-break machine of course can be used as a flat-top or plain rotary if desired but it is not recommended except where the "make up" feature at least is expected to be used.

Roller Drive Bushing

A few years ago "Oilwell" introduced roller drive bushings for reducing the sliding friction of the grief stem as it passes through the drive bushing, thereby greatly decreasing wear on the stem and bushing and assuring a more accurate and uniform feed. This device has proved itself to be very beneficial and is now in quite general use, especially in deep drilling.

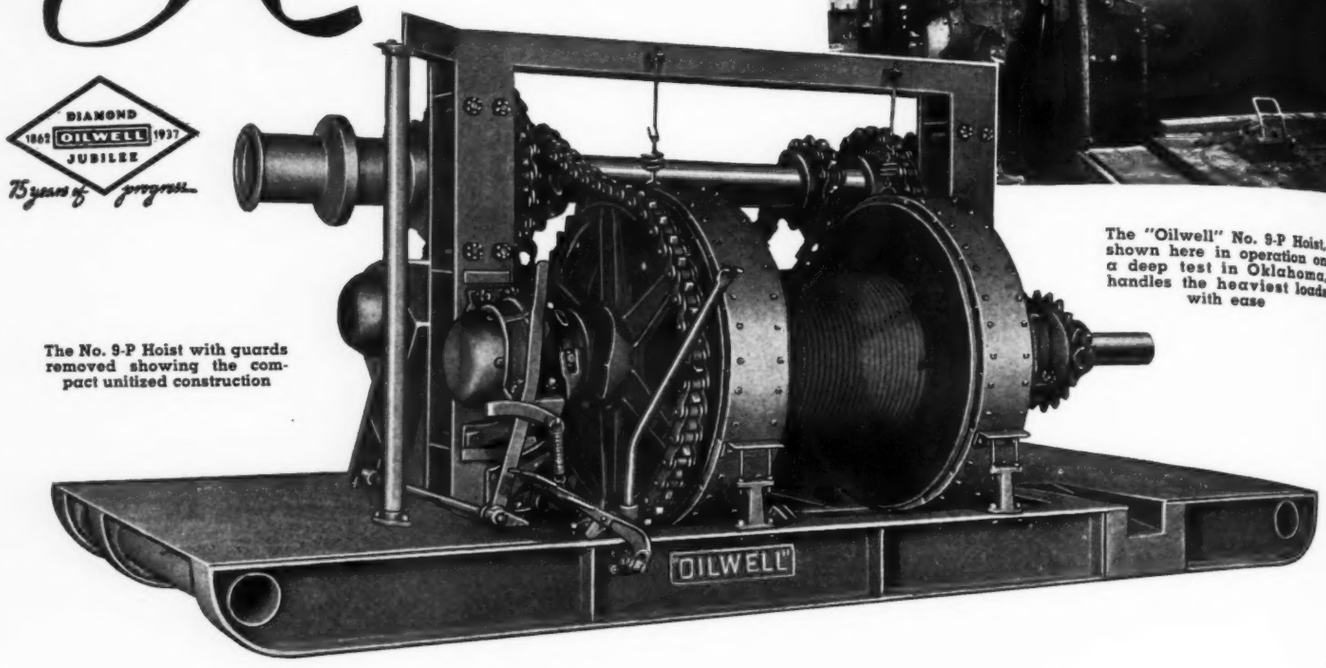
Construction details are given in the following "Oilwell" bulletins:

17-in. Oilbath Rotary—Bulletin No. 158;
27½-in. Oilbath Rotary—Bulletin No. 161;
26-in. Make-and-Break Rotary—Bulletin No. 131;
Roller Drive Bushing—Bulletin No. 137.

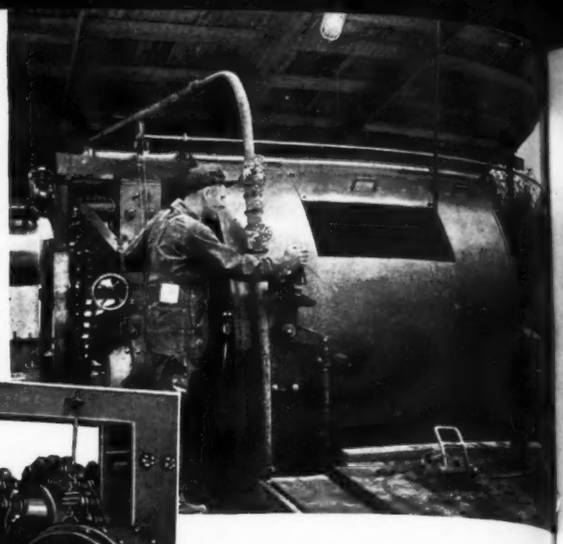
The "Oilwell" Roller Drive Bushing — Its use results in greatly reduced stem and bushing wear and more accurate and uniform control of the weight on the bit

Construction of the "Oilwell" Roller Drive Bushing is simple and sturdy. Interlocking roller cages for various grief-stem sizes are easily and quickly interchanged

Hoists



The No. 9-P Hoist with guards removed showing the compact unitized construction



The "Oilwell" No. 9-P Hoist, shown here in operation on a deep test in Oklahoma, handles the heaviest loads with ease

HOISTING equipment for rotary drilling rigs in recent years has been improved much more from the standpoint of portability and unitization than in any other detail of the construction. In the old days the hoist was completely dismantled, part by part, at each move to a new location. This practice resulted in excessive rigging-up time, gross misalignment of the shafts with their bearings and with each other. The smaller parts of the clutch-shifting and braking mechanisms likewise were seldom in proper alignment. The unitized hoist first appeared about eight years ago and since then much structural improvement eliminating operating difficulties has been made, both in portability and rigidity.

Materials used for hoist shafts, clutches, sprockets, and brakes have been greatly improved and increased in size and capacity to fill the severe demands met in deep wells, including the handling of long strings of heavy drill pipe and casing. The complaint is sometimes heard, however, that the rotary drilling hoist even of today's improved construction still is at best a very crude piece of equipment. It is cumbersome, noisy, and rather inefficient. In defense of the designers, however, it may be pointed out that an extreme range of operating loads and speeds has had to be met. To satisfy this need, particularly the emphatic demand of operators for speed in going into and coming out of the hole, hoist designers were forced to adopt excessive chain speeds and very heavy types of equipment to withstand the attendant extreme shock loads. Emphasis on speed in making a round trip has cost and is costing the drilling industry today infinitely more than it is believed worth because of increased wear and tear, not only on the hoist itself but also on the prime mover, wire line, and drill pipe. A saving of 20 percent in round trip time represents a total saving of only four percent. This is based on being on bottom an average of 80 percent of the total time.

"Oilwell's" line of rotary drilling hoists now consists of three sizes, No. 6-P, No. 7-P, and No. 9-P, the numbers referring to the diameter of the drum shafts. These hoists are suitable for a range of drilling depths in accordance with the various shaft sizes, as follows: from 4000 ft. for the No. 6-P to 10,000 to 12,000 ft. for the No. 9-P. The No. 6-P Hoist lacks expensive refinements of construction because it is for shallow drilling only; however, it is fully unitized and solidly constructed to meet the demands of the work for which it is intended.

The No. 7-P "Oilwell" Hoist is of the most modern design and construction and is suitable for a wide range of depths. One of these recently was used to drill to 9600 ft. in the Gulf Coast and did the job without difficulty. Considering its weight, it is most compactly and ruggedly built. Its design is unique in that it is a two-shaft hoist having four drum-shaft speeds and two speeds to the rotary table. This is accomplished by the use of a double engine sprocket and double chain drive, thus providing for two line-shaft speeds. The catheads are mounted on a special cathead shaft that serves no other purpose.

The "Oilwell" No. 9-P Hoist, which is a fairly recent addition to the line, is applicable to the deepest drilling. It is fully unitized with long skid extensions for easy handling by truck and trailer. Materials of the highest grade are used in shafts, bearings, and sprockets, careful attention being paid to compactness and reduction of weight. Basically the design is of the 3-shaft 4-speed conventional type except that the rotary sprocket and clutch are not overhung from the jack-shaft bearing but are placed between the bearings for greater rigidity. This arrangement also permits the application of a wire-line core-barrel reel drive outboard of the jack-shaft bearing at the rotary-drive end of the jack-shaft without undue overhang.

For very deep drilling and on the heaviest hoists there has been a definite trend toward the use of 1¼-in. drilling lines and an increase in the diameter of the hoist drum. This, in turn, puts greater stress on the hoist chain and brakes for

any given single-line pull and, following a vicious cycle, adds to the weight, cost, and clumsiness of all the hoisting equipment including the prime mover. It is all to no purpose except the single possibility of a slight reduction in the time required to make a round trip. Use of the lighter type equipment with one additional pair of lines strung between the blocks would handle the same loads with much less wear and tear, and only a small sacrifice in round-trip time. As drilling operators continue to analyze their costs more closely, it is quite probable that the extremely heavy hoisting equipment will be replaced by lighter equipment because of the definite economic advantages.

Through close coöperation with rotary chain manufacturers, "Oilwell" about two years ago developed an improved sprocket tooth form to eliminate tooth and chain impact. Accuracy and duplication of this new tooth form are attained by machine-cutting the teeth from the solid rim. This results in accurate tooth pitch and true running, which was not possible with cast-tooth sprockets no matter how careful the foundry practice. It is a revelation to experienced drillers to note the smooth-running chains operating on the new type sprockets; furthermore, chain life is greatly increased. Chain manufacturers are able to produce chain to very close limits of accuracy as regards pitch and parallelism of rollers. Obviously, such close chain accuracy is entirely without advantage unless the chain is used on sprockets of equal accuracy. Thus it is that all "Oilwell" heavy-duty hoists are equipped only with cut-tooth sprockets of alloy heat-treated steel of superior properties that assure long wear-life. "Oilwell's" new cut-tooth sprockets have been in actual field service now for two years with an enviable record of performance.

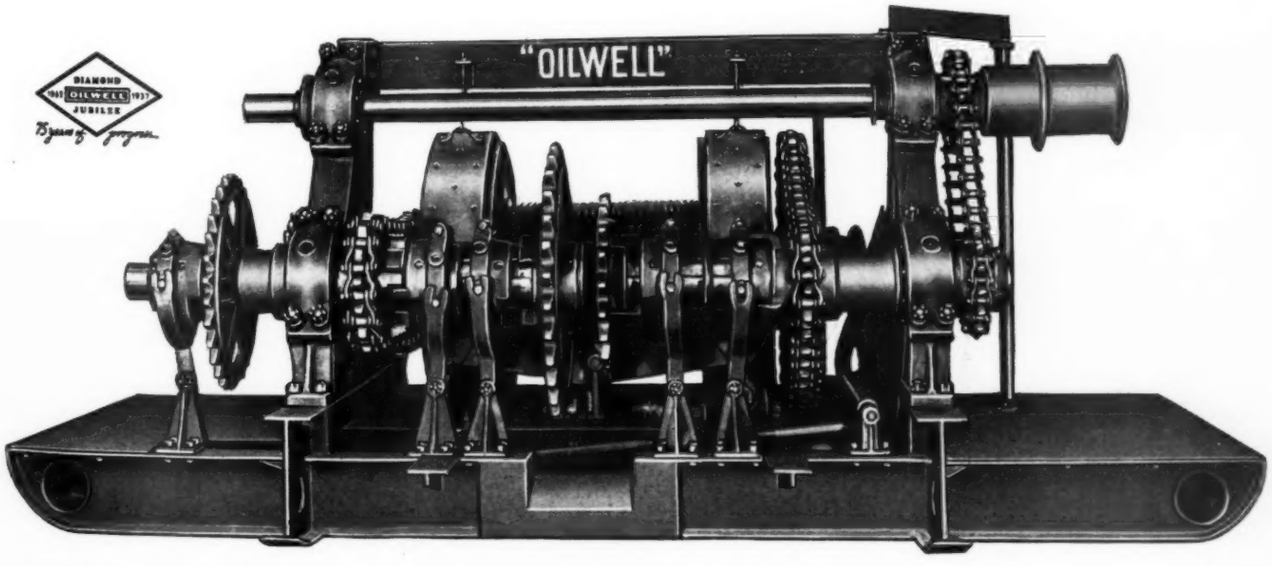
The design and material of the toggle, flanges, and lining in hoist brakes has had the serious attention of hoist manufacturers in recent years. Equilization of the load on the double-brake construction has undergone steady improvement, together with the development of better materials for the flanges and the friction blocks. The preferred method of applying friction material is in relatively short pieces or blocks rather than in continuous lagging, as it results in greater flexibility of the band and better dissipation of heat. It has become the practice recently to use two different types of friction material on the same band, one material having a high coefficient of friction and the other a high resistance to heat. It has been quite definitely determined that on no hoist brake of the continuous-band type does the wear on the friction material occur uniformly throughout the band and that there are localized sections of greatest wear. High heat-resistant material placed at these "hot spots" will result in more uniform wear on all the friction blocks. This will improve the braking action and prolong the wear-life of the brakes. It will also obviate the undesirable practice of fitting a few new friction blocks of full thickness to bands the rest of whose friction blocks may be, and usually are, somewhat worn. The difference in thickness between the old and new friction blocks is unsatisfactory and leads to further trouble.

When a long heavy string of drill pipe being lowered into the hole at high velocity is suddenly stopped, the energy absorbed by the friction brake is tremendous and may be excessive. Controlling the velocity of the drill pipe in such instances is desirable. A hydraulic dynamometer type of retarder on the hoist drumshaft has proved to be a valuable means of limiting the maximum velocity of the drill pipe. The energy to be absorbed by the friction brake in decelerating and bringing the drill pipe to a stop will be reduced in proportion to the limitation placed on the maximum velocity of the drill pipe by the hydraulic retarder. In a deep well the energy absorbed by friction brakes is quite high.

A string of drill pipe weighing 150,000 lb. falling at an average velocity of 90 ft. in 10 seconds or 540 ft. per minute develops approximately 2400 hp., which must be absorbed by the friction brakes in stopping the fall of the pipe. Not many operators realize the magnitude of this energy, which must be dissipated each time a stand of pipe is run into the hole. In their anxiety to speed round trips they have unconsciously added to their operating costs rather than decreased them, just to save a small amount of time. The slower the drill pipe is run into the hole the less the energy to be absorbed in decelerating and stopping the pipe; and the less rapid the deceleration of the drill pipe as the elevators approach the rotary table the longer is the time during which the peak amount of energy must be absorbed by the friction brakes. Thus wear and tear are reduced greatly. Excessive speed in running drill pipe into and out of the hole is a glaring example of "haste makes waste."

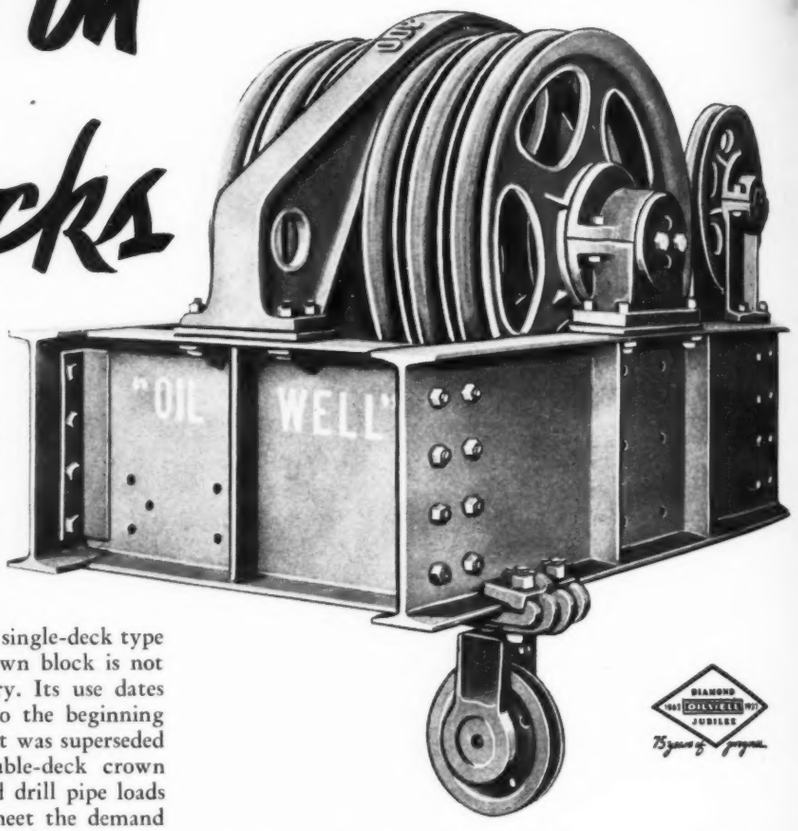
The "Oilwell" No. 7-P Hoist is described in Bulletin No. 154. "Oilwell" Bulletins descriptive of the No. 9-P and No. 6-P Hoists will be released at an early date.

Rear view of the No. 7-P Hoist with guards removed showing double engine sprocket, which provides for two rotary and four hoisting speeds with the use of only two hoist shafts. The third shaft is used only for cathead service



Center-Pin Crown Blocks

"Oilwell" No. 300 Crown Block with Mid-Continent sand-line sheave assembly



THE center-pin single-deck type of drilling crown block is not new to the industry. Its use dates back many years to the beginning of rotary drilling. It was superseded some ten or twelve years ago by the double-deck crown block as holes became deeper and casing and drill pipe loads heavier. The latter type was developed to meet the demand for a block made in two parts or decks in which one part, with its sheave assembly, was suitable for leaving at the top of the derrick as a production block after drilling had been completed. This style block being extremely heavy, very difficult to set in place on the water table, and, of necessity, containing several sheaves of relatively small diameter, it has in recent years lost much of its former popularity, especially since the part remaining in the derrick did not make a very economical production block.

Recognizing the definite limitations of the double-deck block for deep drilling, "Oilwell" engineers set about designing a single-deck crown block with the following important objectives:

1. All drilling-line sheaves must be of relatively large diameter to reduce the internal wear in wire lines of 1⅛-in. and 1¼-in. diameter, which means that the radius of bending of the line must be as great as practicable.

2. The spacing of the sheaves must be as nearly as possible the same laterally as in the traveling block so that, as it approaches the crown block, there will be the least possible angular deflection of the lines, thus preventing line wear against the side of the sheave grooves.

3. The block must be strong, easy to erect on the water table, and free-running.

4. The very best of materials for base, sheaves, and bearings must be used.

All these desirable features have been incorporated in the "Oilwell" No. 200 and No. 300 heavy-duty roller-bearing crown blocks of the single-deck truss-supported center-pin type. The novel truss support for the pin makes possible the advantages of close sheave spacing, easy assembly, and proper load distribution on the water table. In blocks for heavy loads where the main pin is not supported at the center, there is danger of serious pin deflection. When a center beam in the frame is used to support the pin at the center, the sheaves cannot be spaced to advantage. The exclusive "Oilwell" truss support provides adequate pin support against deflection and, because of the effective truss design, causes very little deviation from the most desirable sheave spacing. In addition, the truss construction provides for equal distribution of the total load on the block on each of the four water table members. A uniformly-loaded beam (such as the center pin in the block) carries a load at its center equal to one-half the total load; therefore, in the "Oilwell" block each of the two supporting faces of the truss carries one-fourth of the total load. It is thus apparent that each of the four frame members carries an equal part of the total load, thereby providing a well-balanced construction.

All sheaves are of cast manganese steel and, in order to correct for normal variations in the individual castings, each sheave is statically balanced within close limits before assembly. This precaution results in smooth running, eliminates vibration of the derrick, and is very desirable on large-diameter sheaves running at high speeds.

The sheaves rotate on heavy-duty straight roller bearings with hardened-and-ground removable inner and outer races. Hardened steel spacer plates absorb the side thrust and fully enclose the bearings, which are grease-packed. Grease is applied through individual drilled holes and grooves in the center pin.

Auxiliary equipment, such as cat-line and sand-line sheaves, is provided to meet the various requirements of California and Mid-Continent methods of rig-setting and rigging-up. The assembly of the block, in place on top of the derrick, is easily accomplished as it is handled in only two pieces, neither of which is excessively heavy, and no gin pole of special height is required. "Oilwell" crown-block construction represents the best in design and materials for meeting the most severe requirements.

"Oilwell" No. 200 and No. 300 Crown Blocks are described in Bulletins Nos. 163 and 152 respectively.

Streamline Traveling Blocks

INCREASING depth of hole, weight of drill pipe, and size of drilling lines have combined to create a demand for improved traveling blocks. In the early days of rotary drilling the drill pipe and casing loads were not heavy, the hoisting equipment would not stand high speeds, and satisfactory tool joints had not been developed. The derricks were not so high and the technique of running pipe was not perfected, therefore, the design of the traveling block was not, until recent years, given much attention. Deep drilling and the demand for reduced round-trip time and increased safety have emphasized the need for a strong free-running and well-balanced streamlined traveling block of great capacity but limited in width to clear the fourble board.

The 66-in. and 80-in. "Oilwell" Streamline Blocks meet all these modern requirements. The design has been carefully worked out to eliminate all projections that might cause "hanging up" while running pipe. The center of gravity is low with respect to the center of rotation of the sheaves, thus providing a block that hangs straight at all speeds and is easy to "swing" when necessary.

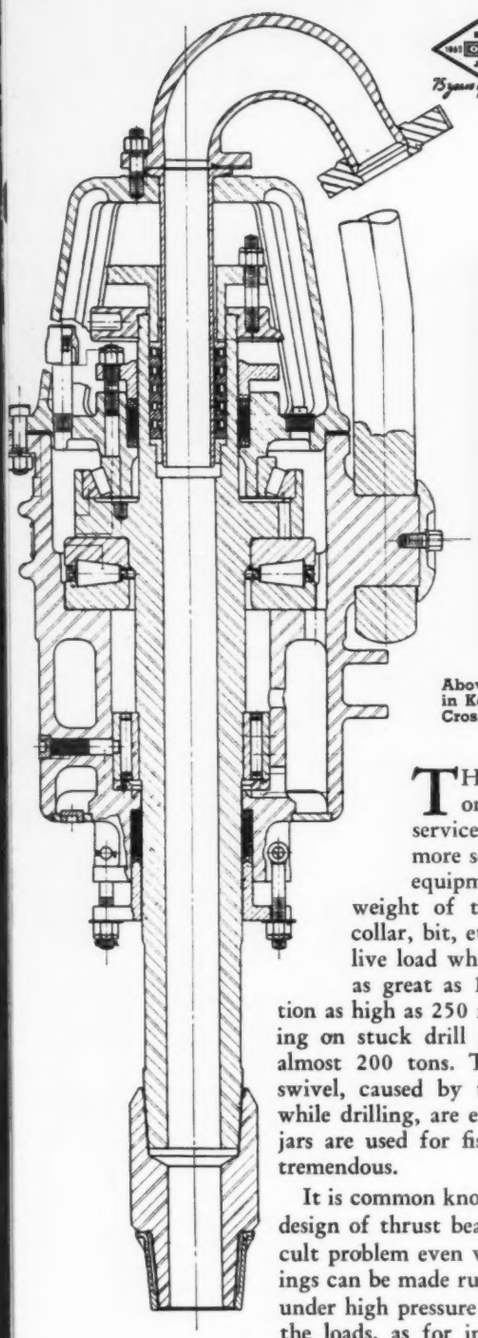
As in "Oilwell" crown blocks, the sheaves are of manganese steel, statically balanced for smooth running and of large diameter to reduce bending of the drilling line. The sheaves and sheave bearings of the 66-in. traveling block and the No. 200 crown block are interchangeable, as also are those of the 80-in. traveling block and the No. 300 crown block. This interchangeability is of considerable advantage to the operator, and also reduces manufacturing costs—a saving that is passed along to the customer. Provision for individual grease lubrication of bearings in "Oilwell" traveling blocks is the same as used in the crown blocks.

"Oilwell" traveling blocks have been used in all the major deep fields with outstanding success and constantly increasing popularity.

"Oilwell" 66-in. and 80-in. Streamline Traveling Blocks are described in Bulletin No. 122.

80-in. Streamline Traveling Block. For heaviest service this big streamliner is matched with the sturdy No. 300 Crown Block

Oilbath Rotary Swivels



Above: "Oilwell" No. 150-A Swivel on well in Kettleman Hills field, California. At left: Cross-sectional view of "Oilwell" No. 150-A Swivel

THE duty imposed on the swivel on a deep-drilling rig, and the service expected of it, probably are more severe than on any other piece of equipment used on the rig. The entire weight of the grief stem, drill pipe, drill collar, bit, etc., is carried by the swivel as a live load while drilling. This weight may be as great as 100 tons and the speed of rotation as high as 250 r.p.m. The dead load when pulling on stuck drill pipe may reach a maximum of almost 200 tons. The normal shock loads on the swivel, caused by the "bounce" of the drill pipe while drilling, are extremely high and where rotary jars are used for fishing jobs these shock loads are tremendous.

It is common knowledge among engineers that the design of thrust bearings of high capacity is a difficult problem even where the mounting of the bearings can be made rugged and forced-feed lubrication under high pressure can be used partially to support the loads, as for instance, in the step bearings on vertical hydraulic turbines. In a rotary drilling swivel all conditions of operation are unfavorable to satisfactory design and construction, yet by continuous contact and experience with the problem since rotary drilling first came into use, "Oilwell" engineers have been able to develop the swivel to a high state of refinement and efficiency.

To be successful the swivel must be as light in weight as possible and of the smallest overall dimensions, as it must resist swinging in the derrick when operated on a crooked or unbalanced grief stem and it must not bend the grief stem when dropped in the rat hole. The main or thrust bearing that carries the weight of the drilling string and the supporting structure that carries the bearing must be ample in capacity to withstand continuously the normal and shock loads while drilling at high speed. The housing must be constructed so that the bail and trunnions, by means of which the swivel is supported from the hook, do not distort the bearing structure and support. The material of the wash pipe and its packing must withstand satisfactorily mud-fluid pressures of 2000 lb. per sq. in. and greater at rotating speeds of 250 r.p.m. and at mud-fluid temperatures as high as 150 deg. fahrenheit. The swivel must be oil-tight to prevent loss of oil from the oilbath. The heat generated within the swivel must be reduced to a minimum because the only means for dissipating this heat is by radiation from the swivel housing and also because only a limited amount can be dissipated by this means. Thus it can be seen that successful swivel performance can be obtained only when these various important requirements have been met by careful design and choice of materials.

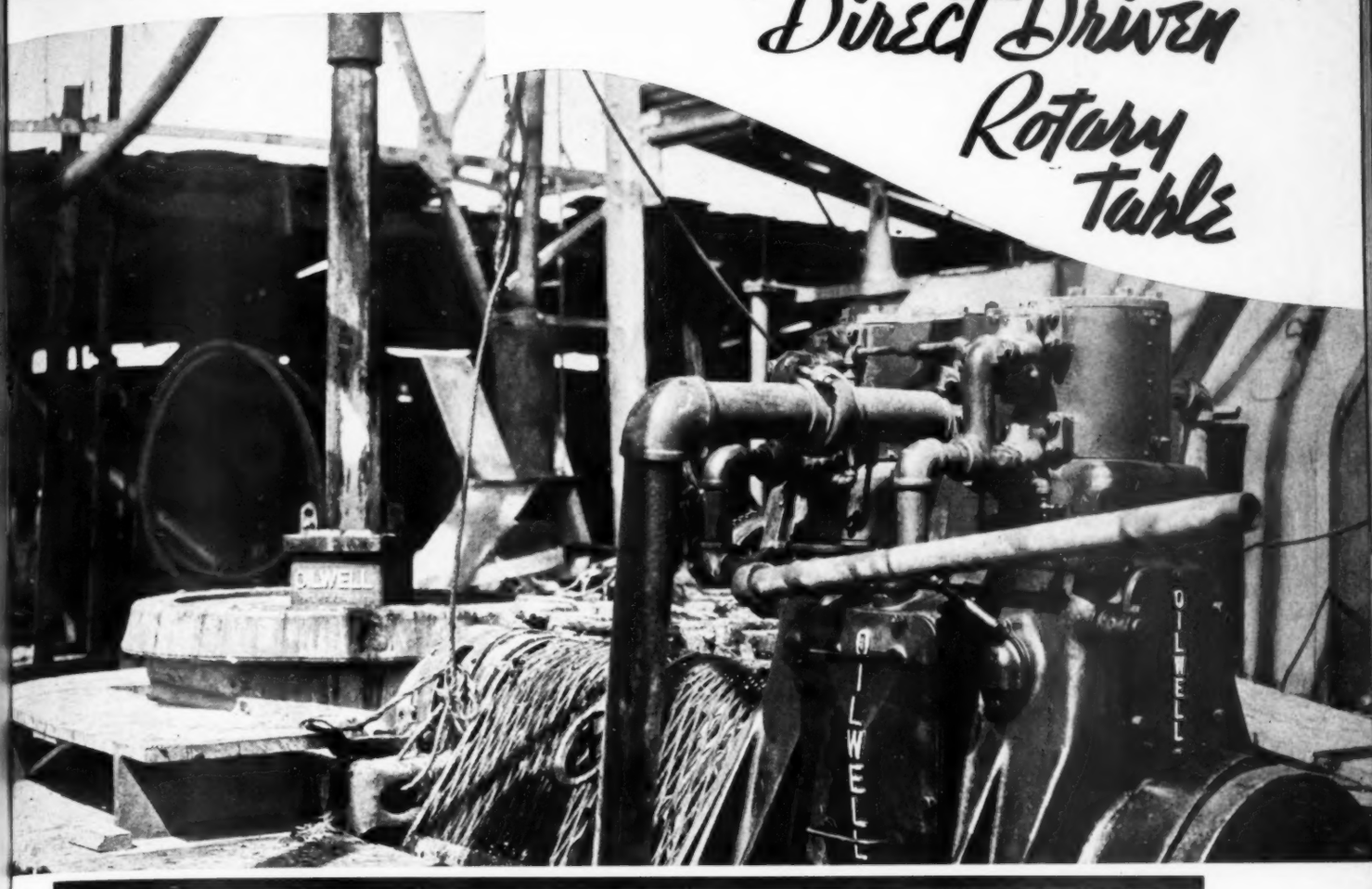
So far as is known "Oilwell" has made the only laboratory load tests on swivel assemblies to determine their load-carrying capacities. In these tests, which are always made when new designs of bearing construction and sizes are contemplated, loads equaling 175 to 200 percent of nominal rating are applied by means of massive levers and weights and the swivel rotated by means of a rotary table and grief stem, the upward force being resisted by a thrust bearing identical with that in the swivel anchored beneath the rotary to the floor. Maximum speeds are obtained and temperatures of the oilbath observed over long periods of time. By means of repeated and exhaustive tests of this kind and constant improvement in the design and materials "Oilwell" swivels have been brought to their present high state of perfection and a load rating determined for each size that is amply conservative to permit the excessive overloading to which the swivels may be subjected in emergencies in the oil fields.

Successful construction of packing and wash-pipe is by no means the simplest of the many problems to be met in swivel design. "Oilwell" within the last year has perfected the external application of a hard-surfacing material known as "Di-Hard" for the wearing surface of wash pipes and thereby has substantially reduced the number of wash-pipe replacements required. This material is exceedingly resistant to abrasion by the packing and the mud-fluid and has a very low coefficient of friction, thereby reducing the wear on packing and the quantity of heat generated. This "Di-Hard" material is the same as that used by "Oilwell" for lining slush-pump liners. "Oilwell" engineers also have developed a special pressure-sealing non-adjustable wash-pipe packing that has reduced greatly the operating cost and shutdown time. This packing is made non-adjustable intentionally because much of the wash-pipe packing trouble in the past has been caused by improper tightening of the packing glands by members of the crew.

The refiners of lubricating oil recently have made a great improvement in lubricants for heavily-loaded roller bearings, known to the trade as "Extreme Pressure" oil. This development has been quite beneficial to swivel operation and no swivel, no matter of what make or type, should be operated with any but "Extreme Pressure" lubricants. It is believed that few operators fully realize the severity of the problems involved in swivel design and manufacture and that if they did, much greater attention would be paid to the lubrication and general care of this vitally important piece of equipment. The best swivel obtainable is inexpensive at almost any price and extra care in its use will pay large dividends.

Detailed information on "Oilwell" No. 100 and No. 150-A Swivels is given in Bulletin No. 144.

Direct Driven Rotary Table



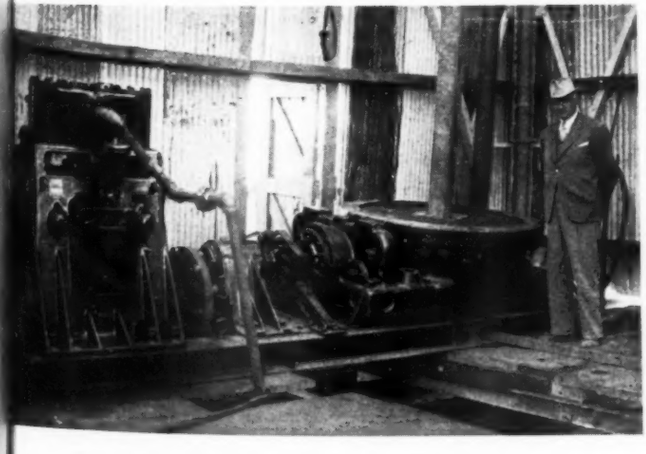
Absence of noise permits normal conversation on this derrick floor in Kansas. The No. 727 Rotary Drilling Unit shown here eliminates the use of the hoist and chain drive for operating the rotary

THE steam economy realized by using a separate steam engine to drive the rotary table, as in the "Oilwell" Drilling Unit, has been mentioned elsewhere in this text. There are, however, many other operating advantages and economies that may be enumerated, as follows:

Eliminates Wear and Replacements of Rotary Chain and Sprockets

Due to the fact that a direct-drive from the engine to the rotary is used, the "Oilwell" Rotary Drilling Unit entirely eliminates the repair and replacement costs that result from wear on rotary chain and sprockets. Because high rotary speeds and deep drilling are very destructive to these parts, the expense and lost time caused by wear on rotary chain and sprockets are now creating a serious problem for drilling operators. On some locations where severe operating conditions are encountered, this expense runs as high as $500.00 a month per rig.

Drilling the Rat Hole with an "Oilwell" Rotary Drilling Unit on a well location at Kettleman Hills, California



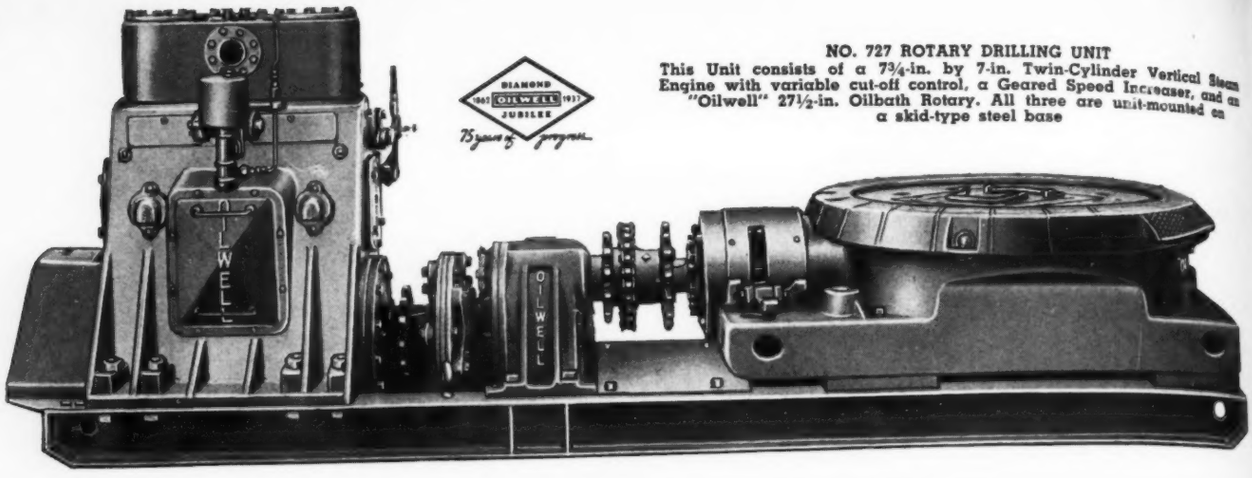
Provides an Effective Means of "Drilling Up"

The "Oilwell" Rotary Drilling Unit makes it possible to "drill up" effectively and easily by using the hoisting engine to raise the drill pipe while it is being rotated independently by the Drilling Unit.

This advantage is of utmost importance, as the Drilling Unit thus provides a simple and effective method of drilling out bridges formed above the bit. Fishing jobs, which would be necessary with conventional drilling equipment, are thereby eliminated.

Reduces Wear-and-Tear on the Rotary, Hoisting Engine, and Drawworks

The "Oilwell" Rotary Drilling Unit reduces wear-and-tear on the hoisting engine and the drawworks by entirely eliminating the use of this equipment during normal drilling operations, which take up fully 80 percent of the total drilling time. It also reduces the wear-and-tear on the rotary, as it eliminates the shocks and strains that are caused by the chain drive used with conventional equipment. The "Oilwell" Rotary Drilling Unit makes it possible to operate the rotary continuously at high speeds without subjecting it to severe strains, and also assures smooth operation at all speeds.



NO. 727 ROTARY DRILLING UNIT
This Unit consists of a 7¾-in. by 7-in. Twin-Cylinder Vertical Steam Engine with variable cut-off control, a Geared Speed Increaser, and an "Oilwell" 27½-in. Oilbath Rotary. All three are unit-mounted on a skid-type steel base

Eliminates Chain Noise

The "Oilwell" Rotary Drilling Unit eliminates the loud clatter of the rotary drive chain by providing a direct-drive to the rotary. The rig is so quiet in operation that conversation can be carried on in a normal tone of voice on the derrick floor. This advantage is specially important as it enables the driller to detect instantly any unusual noise about the rig and to determine its cause promptly, thus preventing accidents and break-downs—and increasing safety. The absence of noise contributes considerably to the alertness of the driller, especially during the latter part of his tour, as his nerves are not fatigued by the continuous clatter of a chain drive.

Makes Substantial Saving in Lubrication Costs

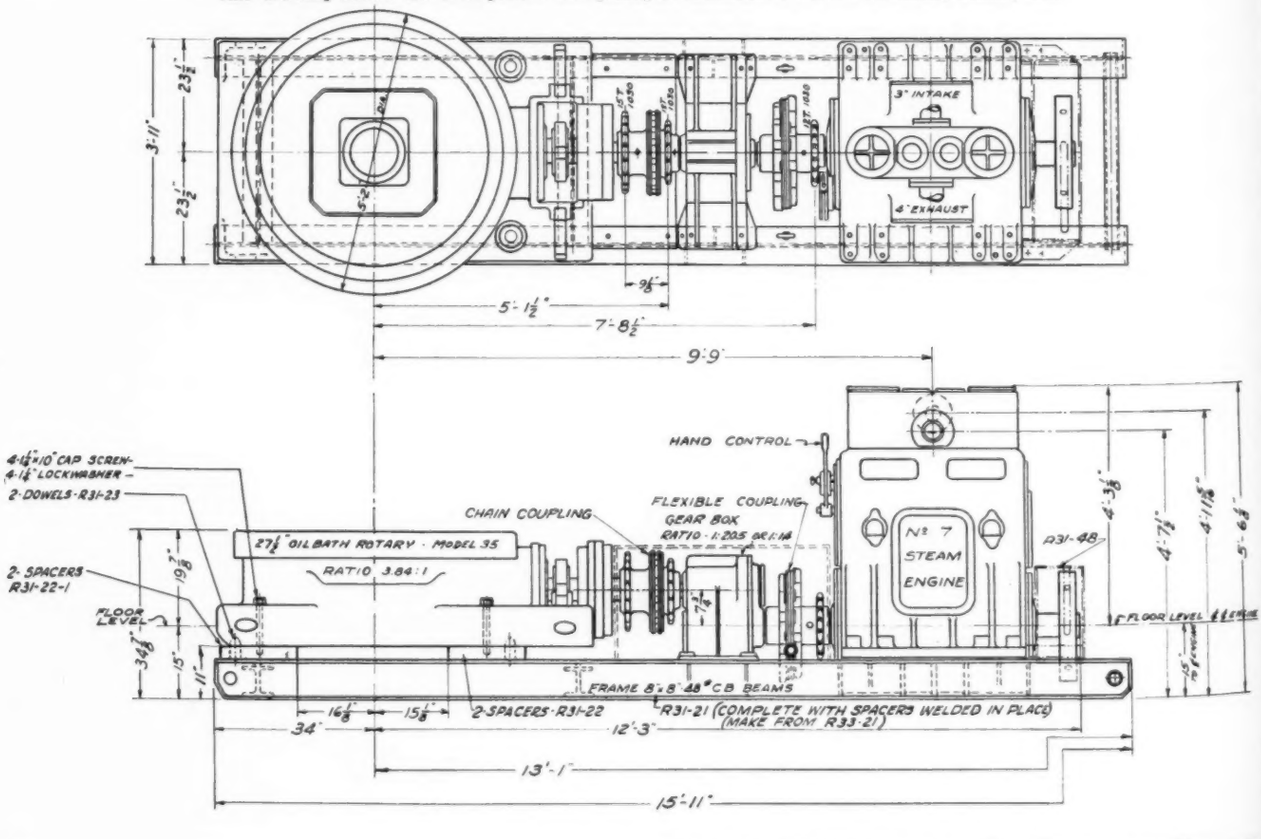
The No. 7 engine requires less cylinder oil and only about 25 percent as much crankcase oil when driving the rotary as a full-size hoisting engine. A further saving in lubrication expense is effected by elimination of the chain drive.

Saves Time in Breaking-out Drill Pipe

The "Oilwell" Rotary Drilling Unit simplifies the breaking-out of drill pipe and saves both time and wear-and-tear by eliminating the use of clutches and the straining of equipment.

The driller controls at will the hoisting engine and also the engine that powers the Drilling Unit, as the throttle valves for both engines are operated from his usual position. When breaking-out pipe, he breaks the joint with the automatic cathead and then backs it out with the rotary merely by opening the throttle valve of the Drilling Unit Engine. The moment the joint is backed out, the spring hook lifts the stand free. The driller does not throw any clutches, nor does he reverse either engine.

This drawing shows the arrangement and principal dimensions of the No. 727 Rotary Drilling Unit



Makes "Spudding" Easier and More Effective

The "Oilwell" Rotary Drilling Unit greatly simplifies "spudding" and makes it very effective, as the hoist and rotary can be operated simultaneously and independently. The driller can raise and lower the pipe at will while the rotary is in operation, and thus is provided with an effective means of clearing the bit when it is "balled."

Gives the Driller Better Control of the Drill Pipe and Bit

The "Oilwell" Rotary Drilling Unit gives the driller better control of the drill pipe and bit than is possible with conventional equipment. It also reduces the danger of overstressing the drill pipe and bit. In the first place, the direct-drive from the engine to the rotary gives the driller accurate and instant control of the drill pipe and bit. In the second place, if the formation tends to stop the rotation of the bit and the manifold pressure builds up in the engine, there is much less danger of a "twist-off" when the "Oilwell" Rotary Drilling Unit is used than when the rotary is driven by the hoisting engine. This is due to the fact that the change in torque corresponding to a given change in manifold pressure is much smaller in the No. 7 Engine used on the Drilling Unit than in the big hoisting engine.

Saves Valuable Space on the Derrick Floor

The "Oilwell" Rotary Drilling Unit saves valuable space on the derrick floor and adds to the safety of the crew, as it entirely eliminates the rotary drive chain and its cumbersome guard and occupies what otherwise would be considered dead space. Its design is such that its base can be dropped between the derrick floor joists so that the top of the rotary stands at its normal height and the top of the engine is only about four ft. above the derrick floor. It is small, compact and low, and is entirely out of the way in both the Mid Continent and the California set-ups as shown in Figs. 1 and 2 on this page.

Provides an Auxiliary Prime Mover for Emergency Hoisting Requirements

The "Oilwell" Rotary Drilling Unit is equipped with two sprockets that make it possible to use the No. 7 Engine for pulling the drill pipe should the hoisting engine fail. With a California set-up, an auxiliary chain drive can be installed between the calf wheel or auxiliary hoist, to which the dead end of the drilling line is anchored, and the sprocket, which is mounted on the disc-type flexible coupling of the Unit adjacent to the engine. With the Mid-Continent set-up, an auxiliary chain drive can be installed between the rotary sprocket of the regular drawworks and the sprocket, which is integral with the gear-box half of the chain-type flexible coupling. When the engine of the Drilling Unit is used for emergency hoisting service, the rotary is disconnected by removing the chain from the chain-type flexible coupling. The auxiliary chain drives are shown in Figs. 1 and 2 on this page.

Simplifies Drilling the Rathole

The "Oilwell" Rotary Drilling Unit simplifies drilling the rathole, as the entire unit can be moved easily into position and the necessary drilling completed within a few minutes. It eliminates the necessity of installing a special rat-hole sprocket on the hoist and dragging a long drive chain across the derrick floor. It not only saves time and expense in this service but also enhances the safety of the crew.

Is Light and Portable and is Easily Installed

The "Oilwell" Rotary Drilling Unit is light, weighing only slightly more than 19,000 lb. when equipped with the "Oilwell" 27½-in. Oilbath Rotary, and is easily transported and installed. The design and dimensions of the rugged skid-type base provide maximum convenience when handling the unit with a truck and also when rigging-up.

The "Oilwell" Drilling Unit, consisting of 7¾-in. by 7-in. Twin Vertical Steam Engine, Gear Box, and Rotary, together with flexible couplings for driving, all mounted on a unitary base, represents one of the most outstanding developments for rotary drilling introduced in recent years. The first unit of this type was placed in service in Kettleman Hills early in 1935 and since that time a steadily increasing number have been demonstrating the many advantages, in various oil fields in this country and abroad.

Detailed specifications covering "Oilwell" Rotary Drilling Units are given in Bulletin No. 145-A.

FIG 1.
DRILLING UNIT WITH AUXILIARY DRIVE TO STANDBY HOIST OR CALF WHEEL

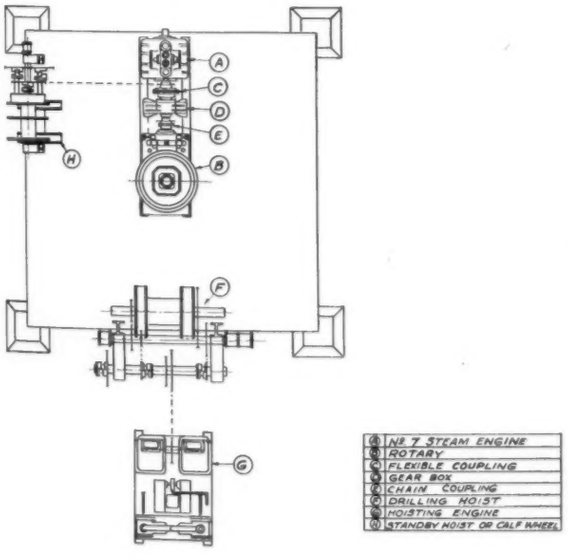
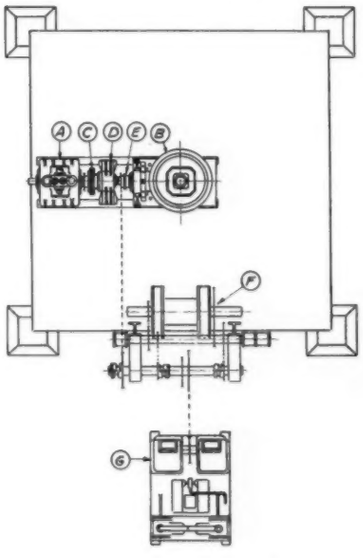


FIG. 2.
DRILLING UNIT WITH AUXILIARY DRIVE TO DRILLING HOIST



DIAMOND 1863 OILWELL 1937 JUBILEE
75 years of progress

The floor plan at the left (Fig. 1) shows an "Oilwell" Rotary Drilling Unit installed in accordance with customary California practice. A typical Mid-Continent hookup is shown at the right (Fig. 2)

Portable Double Steam-Engine Drive for Rotary Drilling Rig

IN order to reduce further the cost of drilling with steam rotary rigs "Oilwell," about a year ago, introduced its portable double No. 7 Steam Engine Power Unit for driving hoist, rotary table, and power slush pump. The engines, two in number, are mounted on a rugged skid structure that also carries all clutches, bearings, power take-offs, steam piping and control valves, and valve gear connections. The total assembled weight is well within easy limits of transportation and also is well distributed over the long skids so that moving from location to location is exceedingly simple.

Rigging-up time is reduced to a minimum as no complicated or massive foundation is required and the unit is entirely self-contained. It is only necessary to connect steam and exhaust lines, put chains on hoist and power slush pump, connect the throttle control to the driller's position, and the unit is ready.

Low consumption of both fuel and water is an outstanding advantage of this type of power plant. When drilling, one engine drives the power slush pump entirely independent of the other engine. At a boiler pressure of 300 to 350 lb. per sq. in. this one engine has ample power, at an economical cut-off, to drive the pump with a minimum consumption of fuel and water, as pointed out earlier in the text. The second engine turns the rotary table through the line shaft of the hoist and has ample power to do the work at relatively slow engine speeds, even at the higher rotary speeds. When driving through the "Oilwell" 7-P hoist two table speeds are available for each engine speed, an arrangement that may be very desirable where slow-speed coring is to be done. A cut-off control also is provided for the drilling engine in order that there will be the greatest possible economy of fuel and water. This rig will drill easily to 4000 ft. where a boiler pressure of 300 to 350 lb. per sq. in. is employed with an "Oilwell" No. 14-P Power Slush Pump, a 100-hp. boiler, and a separately-fired superheater.

For making a round trip the engine driving the pump is unclutched from the power pump and clutched to the engine driving the hoist by a simple and convenient clutch-shifting arrangement. This arrangement also includes tying the valve gears of the two engines together so that both engines are simultaneously under the control of the driller, whether in forward or reverse rotation, and the full power output of both engines is thus made available for rapid handling of the drill pipe into and out of the hole. When making a connection the single drilling engine has ample power to raise the drill pipe without difficulty.

Field operations of these double engine units, where fuel consumption has been measured, show a reduction in fuel and water cost of more than 50 percent below that of the conventional type of rig. Less time is consumed in setting-up and the flexibility of operation is much improved.

The "Oilwell" No. 7 Portable Double Engine Drive is described in Bulletin No. 164.

"Oilwell" Portable Double Steam-Engine Drive on a rotary rig near Prague, Oklahoma

"OILWELL" Brantly Rotary Feed Control

An "Oilwell" Brantly Rotary Feed Control in service at Oklahoma City

DIAMOND JUBILEE 1862 OILWELL 1937 75 years of progress

THE "Oilwell" Brantly Rotary Feed Control is manufactured and sold by "Oilwell" under an exclusive license arrangement with J. E. Brantly, president of the Drilling and Exploration Company of Dallas, Texas. Mr. Brantly invented his means of uniformly feeding the drill pipe into the hole during drilling after several years of extensive drilling experience in both foreign and domestic fields. The device, as now manufactured, has proved quite effective in substantiating Mr. Brantly's claims regarding the benefits to be derived from the use of his ideas for controlled drilling.

In ordinary rotary drilling, the tension in the drilling line as it unspools from the hoist drum is resisted by the hoist brake under the control of the driller. When using the "Oilwell" Brantly Rotary Feed Control, the torque or turning effort on the drum shaft, which results from the tension in the drilling line, is used as a source of power to drive a multi-cylinder power pump through a speed multiplier or gear box. In this manner the high tension in the drilling line, incident to handling heavy strings of drill pipe, and the exceedingly low speed of the hoisting drum, incident to drilling at low rates of speed in hard formations, are transformed into low torque and sufficiently high speeds at the pump shaft to provide conservative pump pressures and satisfactory rates of fluid discharge.

The pump suction is from a water tank, which is mounted on the skids of the "Oilwell" Brantly Rotary Feed Control, and the water discharged by the pump is returned to this tank after passing through the discharge manifold. In using the Feed Control, the driller adjusts the rate of feed by opening and closing the valves in the discharge manifold. The regular weight indicator informs the driller on the weight of the bit and he adjusts the manifold valves accordingly.

The several outstanding advantages of this device may be outlined as follows:

1. More Hole Per Bit

It is fully recognized that a uniform pressure on any cutting tool is necessary in order to obtain the maximum cutting-life and capacity from the tool. In the metal-cutting industry, for example, uniform feeds are essential to the successful operation of drill presses, lathes, etc. Hand-feeding of a tool by a machinist results in inefficient removal of the material and also in reduced cutting-life of the tool. In rotary drilling, the same conditions apply, and the same beneficial results are obtained from positive and uniform feeding of a rotary drilling bit as are obtained from proper feeding of a tool used for cutting metal. A rotary drilling rig is nothing more than a huge drill press that uses slush as a cutting compound.

"More hole per bit" means "fewer bits per hole" and a reduction of bit costs.

2. More Hole Per Hour

When the "Oilwell" Brantly Rotary Feed Control is used "bit-life" is prolonged, hence fewer round trips are required for replacing bits. This results in increasing the percentage of time the bit is "on the bottom," therefore, "more hole per hour."

3. Straighter Hole

Uniform weight on the bit is essential for straight-hole drilling, now very important as all major operators permit only a slight deviation from vertical. The "Oilwell" Brantly Rotary Feed Control provides means for drilling straight holes without loss of time, as it feeds the drilling line from the drum at a uniform rate instead of irregularly as is the case with hand-feeding by a driller releasing the brake intermittently. The Feed Control reduces plugging-back and redrilling jobs.

4. Makes Drilling Safer and Easier

Even though the driller does not happen to be near the controls when a sudden change in drilling conditions occurs, there is little danger of a twist-off or similar trouble when the "Oilwell" Brantly Rotary Feed Control is used, because a sudden change in drilling conditions cannot affect the rate of feed immediately. For instance, if the bit should strike a fissure when the manifold valves of the Feed Control are set for a given rate of feed, the drill pipe could not drop immediately, as

Driller regulating the rate of feed with orifice valve in the discharge manifold. The hoist brake is entirely released while drilling with the "Oilwell" Brantly Rotary Feed Control

the Feed Control would not feed any faster than the rate for which the valves are adjusted. This "lag" gives the driller ample time to catch the drill pipe before any damage is done.

If the bit is broken or strikes a shell or for any other reason ceases to cut at the rate of feed for which the Feed Control is set, the decreased tension in the drilling line tends to reduce the speed of the Feed Control because of the decreased torque available for driving it.

5. Feeds the Line Smoothly from the Drum and Holds a Uniform Weight on the Bit

It is physically impossible for a driller to keep the brake adjusted so accurately that the drilling line will be fed from the drum at a rate approaching uniformity. The best he can do is to feed the line in "bunches," with the result that the weight on the bit is varying continually. When drilling with the "Oilwell" Brantly Rotary Feed Control, the brake lever is released entirely and the rate of feed is absolutely uniform. This absolute uniformity of feed holds true whether the drilling rate is one ft. an hour or 50 ft. an hour. This is an advantage when reaming or coring, as well as when drilling.

6. Feeds at Any Rate from One ft. an Hour to 50 ft. an Hour

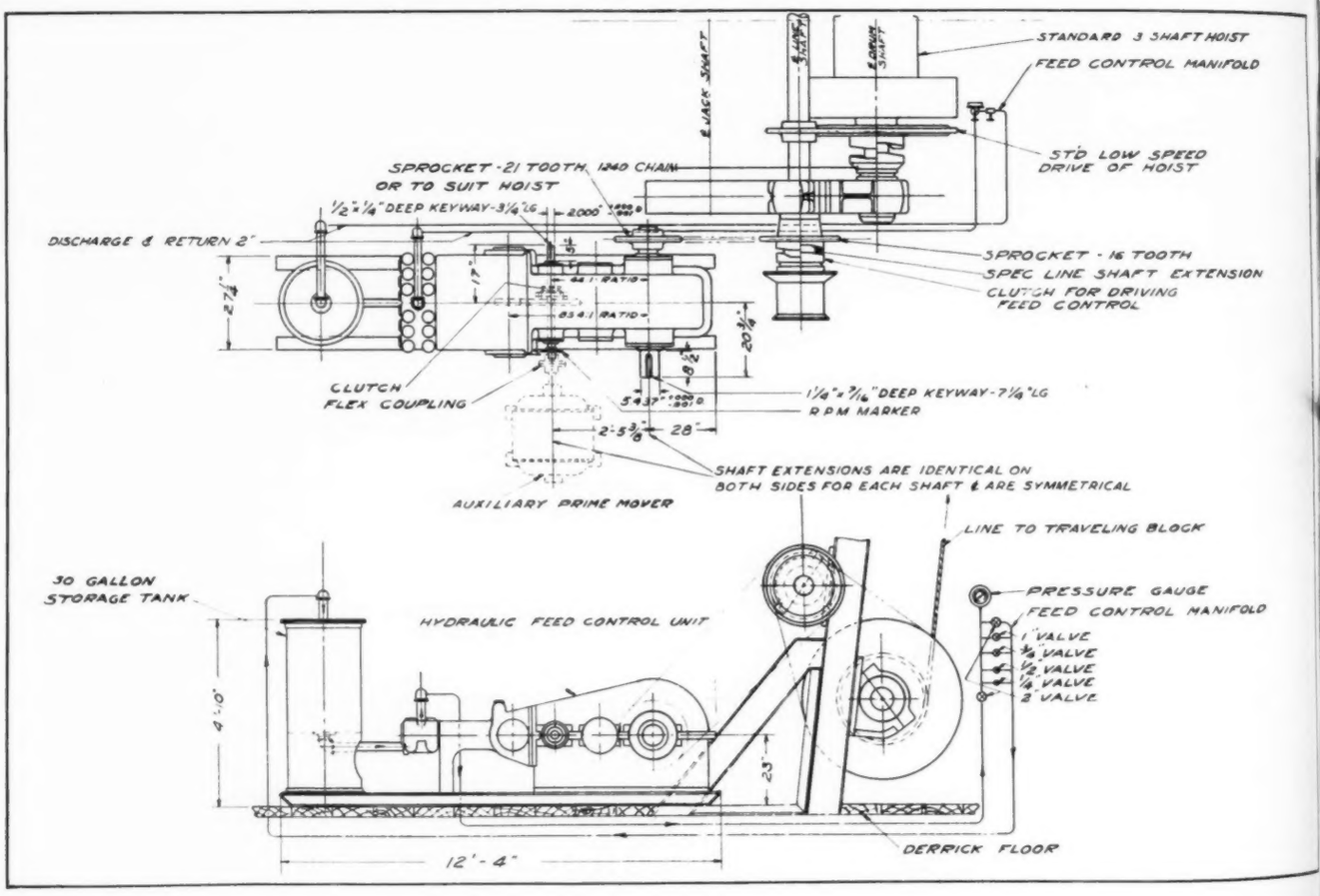
The speed ratio between the drum shaft of the hoist and the pump shaft of the "Oilwell" Brantly Rotary Control is such that even at very low rates of feed the quantity of liquid discharged by the pump is sufficient to permit accurate control without the adjustment being unduly sensitive or unstable. At higher rates of feed the quantity of fluid discharged, of course, is greater. A full range of orifice sizes is provided by the manifold valves to cover the complete range of feeding rates.

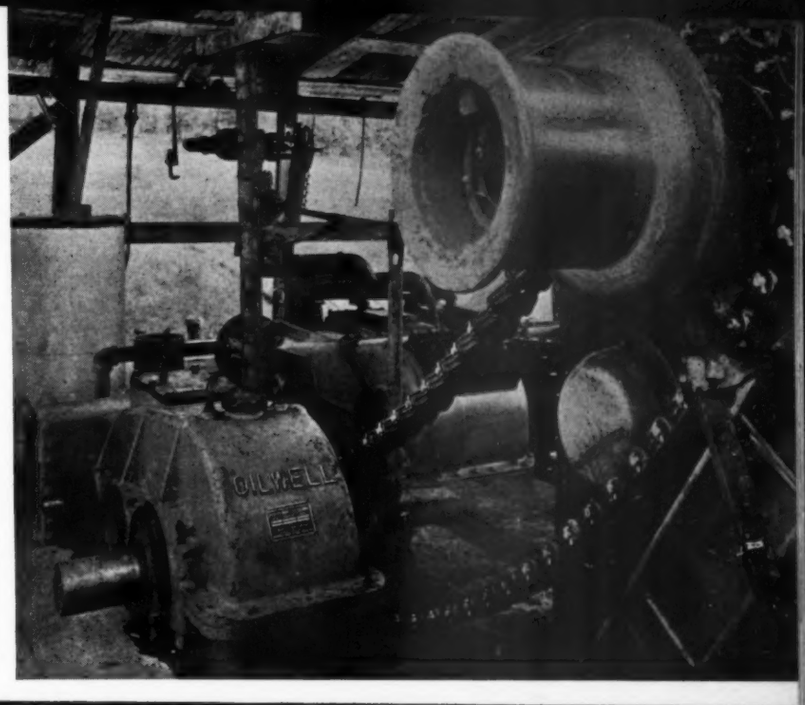
7. Will Hold a Drill Pipe Load of 200,000 lb. Off Bottom

The heaviest drill pipe loads can be held off bottom by closing all the manifold valves of the "Oilwell" Brantly Rotary Feed Control and thus stalling the pump and preventing the drum from turning. This can be done without creating any excessive pressure on the 6-cylinder double-acting pump, which is so proportioned as to keep maximum working pressures relatively low. For instance, with a 200,000-lb. drill pipe load, eight lines of the derrick and an average spooling diameter on the drum of 32 in., the maximum pump discharge pressure will not exceed 170 lb. per sq. inch. As a result of the low pump pressures, the working parts require a minimum amount of repair and attention and will resist wear almost indefinitely. The working parts of the power end of the pump and all speed-reducing gears of the Feed Control run in a fully-enclosed oilbath.

Summary. The "Oilwell" Brantly Rotary Feed Control is particularly adapted to rock-bit drilling and, where reasonably accurate records of bit costs have been kept in drilling hard formations, the indicated reduction in bit costs alone shows that the device has paid for itself in a few months of service. Straighter hole has been drilled under

This drawing illustrates the installation of an "Oilwell" Brantly Rotary Feed Control with drive from the line shaft of a three-shaft hoist


STANDARD 3 SHAFT HOIST
FEED CONTROL MANIFOLD
STD LOW SPEED DRIVE OF HOIST
SPROCKET - 21 TOOTH, 1240 CHAIN OR TO SUIT HOIST
½"x¼" DEEP KEYWAY - 3¼" LG
DISCHARGE & RETURN 2"
SPROCKET - 16 TOOTH
SPEC LINE SHAFT EXTENSION
CLUTCH FOR DRIVING FEED CONTROL
CLUTCH FLEX COUPLING
¼"x 3/16" DEEP KEYWAY - 7⅛" LG
R.P.M MARKER
SHAFT EXTENSIONS ARE IDENTICAL ON BOTH SIDES FOR EACH SHAFT & ARE SYMMETRICAL
AUXILIARY PRIME MOVER
LINE TO TRAVELING BLOCK
30 GALLON STORAGE TANK
HYDRAULIC FEED CONTROL UNIT
PRESSURE GAUGE
FEED CONTROL MANIFOLD
1" VALVE
¾" VALVE
½" VALVE
¼" VALVE
2" VALVE
DERRICK FLOOR
12'-4"



This photograph shows the chain drive from the line shaft of an "Oilwell" No. 9-P Hoist to the low-speed shaft of the Feed Control

the most difficult conditions, such as steeply-dipping formations. The device is unique in that it requires no source of outside power to operate, hence the operating cost is extremely low. The weight of the drill pipe, which ordinarily is a hazard to be reckoned with, is put to work to control its own rate of descent into the hole while the bit is on bottom.

The "Oilwell" Brantly Rotary Feed Control is illustrated and described in Bulletin No. 135.

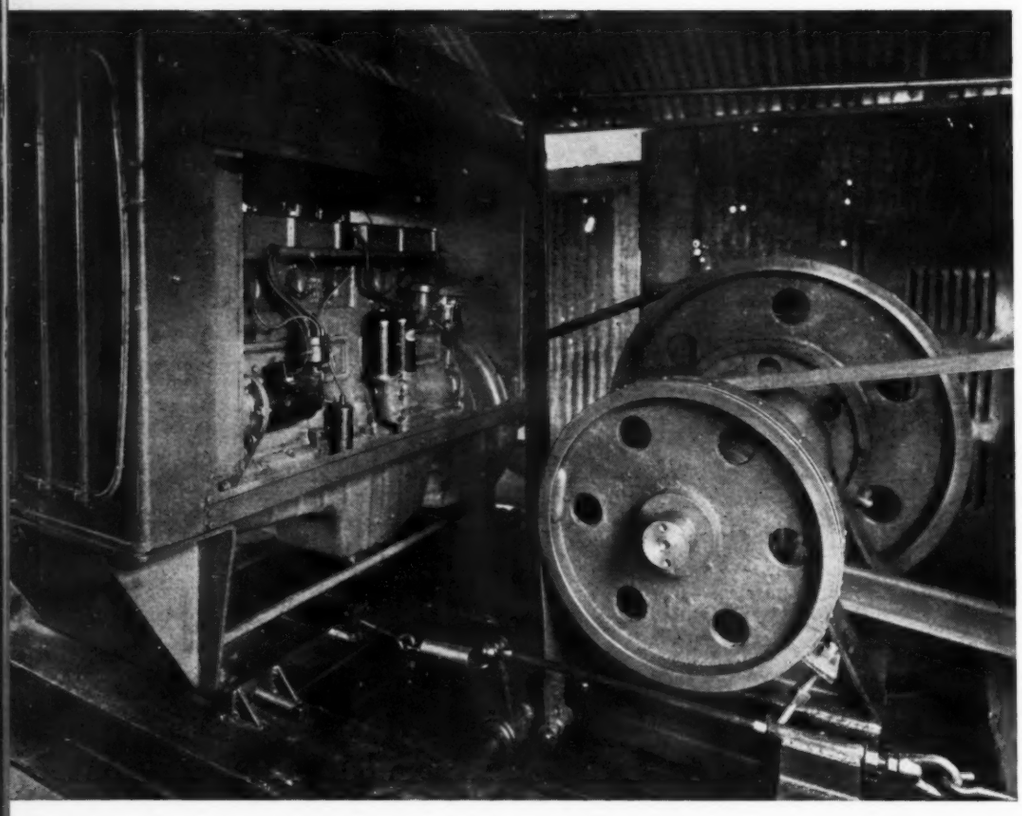
The "Oilwell" Brantly Rotary Feed Control is a portable self-contained unit consisting of a fully-enclosed geared speed increaser with integral 6-cylinder pump and a water tank mounted on steel skids

Summary of Rotary Drilling Equipment

THE foregoing text probably represents the most complete disclosure of the history and advancement of steam-driven rotary-drilling equipment ever gathered together and published as a unit for the particular benefit of engineers in the drilling industry. It is a frank discussion of the general construction and advantages of modern equipment now available and gives concrete information on the economies and benefits to be derived from its use. In the limited space available it is not possible to cover in complete detail the construction of all items of equipment, but separate bulletins that include field photographs, drawings, and specifications are available upon request.

"Oilwell's" decision of several years' standing to provide adequate, economical and up-to-date steam equipment, and to assist in disseminating information to the oil industry concerning the efficient use of this equipment for rotary drilling already has been justified by the increasing acceptance of the equipment and the sound economic principles involved in its operation.

"Oilwell" is deeply indebted to its customers, many of whom saw in advance the need for lower drilling costs and better drilling machinery and were instrumental in suggesting the new requirements as well as in offering assistance in putting the new equipment into field operation initially. Much still remains to be done and "Oilwell" is constantly striving toward greater economy and efficiency in rotary drilling equipment with the lowest possible drilling costs always the ultimate goal.



DIAMOND 1862 OILWELL 1937 JUBILEE
75 years of progress

★ Cable Tool Drilling Equipment

An "Oilwell" Imperial No. 2 Cable-Tool Drilling Unit in an oil field in Eastern U. S. Not illustrated are the controls governing the neutral brake, the reversible clutch, and the engine speed. They are conveniently placed at the driller's position.

OIL Well Supply Company is celebrating this year its seventy-fifth anniversary as a source of oil-field equipment and supplies for the oil industry. During all these seventy-five years "Oilwell" has been associated continuously with the varying needs of the cable-tool or percussion system of drilling wells for oil, gas, and water.

Although the earliest wells were drilled with spring poles for giving impact to the tools, it was not long until the walking beam and temper screw came into general use. Basically the types of tools and equipment in cable-tool drilling today differ very little, if any, from those used 40 or 50 years ago. Power requirements, of course, are greater on account of increased depths, but the type of equipment and methods of operation have not changed greatly. There has been much improvement in materials for bits, jars, stems, hoisting equipment, fishing tools, etc., and this fact can be accounted for largely by the pronounced advance in metallurgy and heat-treatment of steels during the past 25 or 30 years.

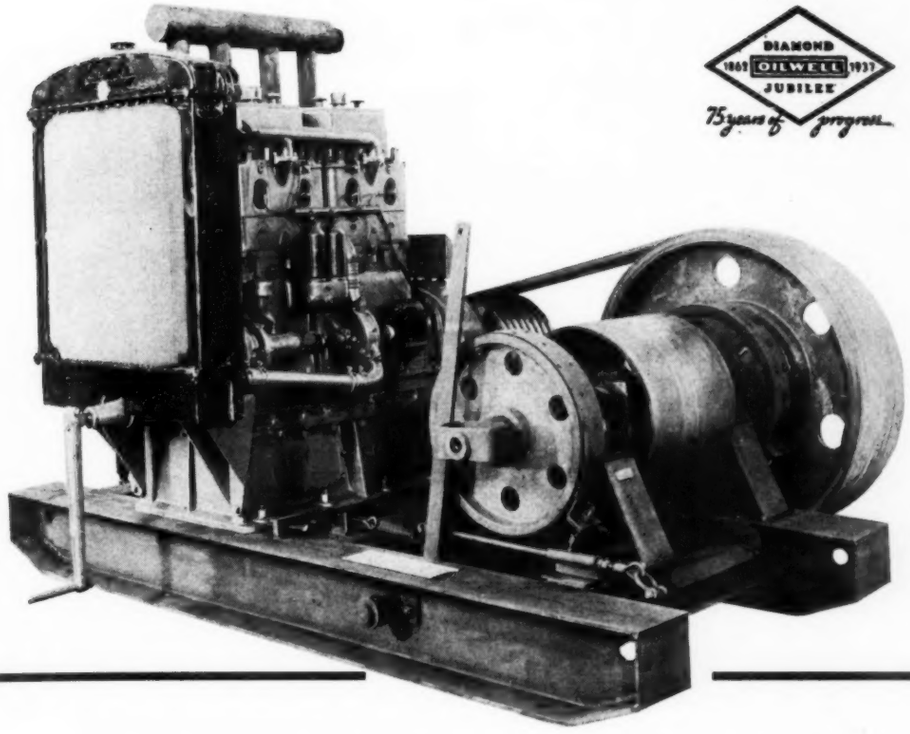
"Oilwell" led in the development of the box-and-pin joint used for attaching together the various tools in the drilling string. For many years "Oilwell" cable-tool joints were considered standard by many manufacturers and users and finally, several years ago, the American Petroleum Institute adopted the "Oilwell" joint as its standard.

"Oilwell" led in the practice of heating the pins and boxes of bits, stems, and jars, practically eliminating the previously common experience of "jumped" pins.

"Oilwell" also developed, through its United States Steel Corporation affiliates, the weldless forged-steel drilling stem. Previously stems had been made by fire-welding the box and pin ends to a rolled round bar. This is a development of recent years that has extended greatly the useful life of this tool in deep, hard drilling.

Within the last two years "Oilwell" has perfected the manufacture of a drilling jar that permits the use of alloy steel with its attendant benefits derived from careful heat-treatment of the steel. With the exception of the weldless jar, machined from the solid bar, the practice previously had been to make a fire-weld in the reins of the jars after mating the two members. This practice not only resulted in a considerable percentage of imperfect welds in a vital spot in the jar, but also eliminated the possibility of heat-treatment of the finished jar because of the fire-weld. "Oilwell's" new jar is split lengthwise of the tongue of one of the members for mating the parts and is then electrically-welded at the split section, the reins being made integral with the boxes and pins and machined from the solid after die-forging to shape. This construction permits the use of alloy steel fully heat-treated to obtain the best wearing qualities, and highest impact values in the knocking heads and reins. This new "Oilwell" cable-tool product is making a record of economy and service in the most difficult drilling and is greatly reducing drilling cost.

Probably the most important change in the cable-tool rig is that of using the internal-combustion engine as prime mover in place of the single-cylinder steam engine. Recently "Oilwell" pioneered the unitized and portable internal-combustion engine type of cable-tool power unit consisting of engine and reverse clutch mounted on substantial steel skids.



The "Oilwell" Imperial No. 3 Cable-Tool Drilling Unit is designed for the heavy loads encountered in deep cable-tool drilling

These units are powered with multi-cylinder or single-cylinder engines with convertible features for gas or liquid fuels.

Engines have been selected with a wide speed range so as to obtain bandwheel speeds ranging from 15 r.p.m. for fishing and bailing up to 75 and 80 r.p.m. for pulling the tools or bailer out of the hole.

All operating controls are in their accustomed position on the rig, insuring maximum convenience to the drilling crew.

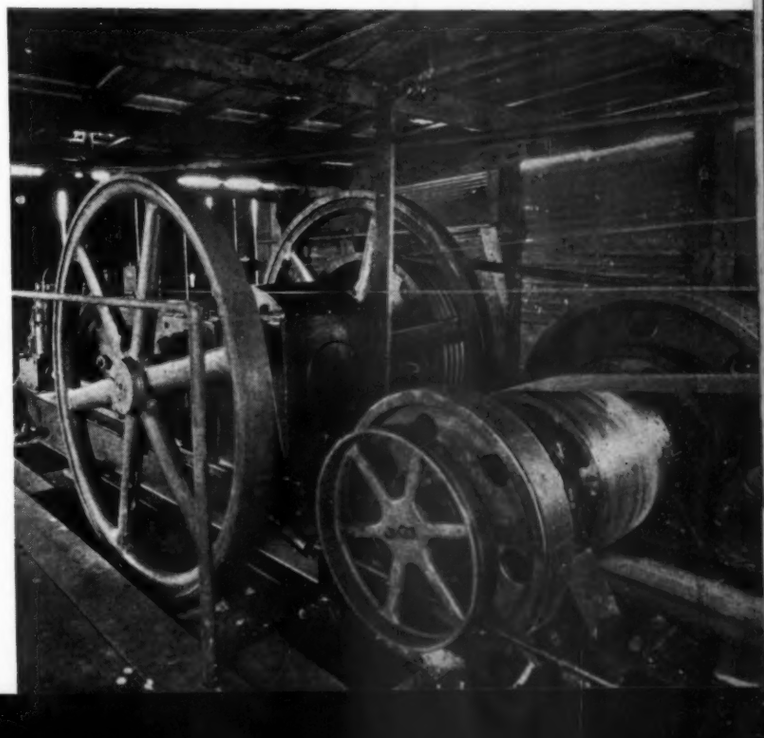
The clutch is easy to engage in both the forward and reverse positions. The reverse-gear mechanism automatically locks into position so that it is not necessary to hold the clutch control lever in the reverse position.

A neutral brake is mounted on the clutch countershaft, the foot-pedal control being placed adjacent to the samson post, convenient to the driller. The brake is used to stop the tools and hold them in position when running forward or in reverse. The brake also is used when spotting the crank to hook up the pitman and when hitching over.

The bandwheel belt is tightened by adjusting the jack between the bumping pole and the unit so that it is not necessary to cut the belt to tighten it.

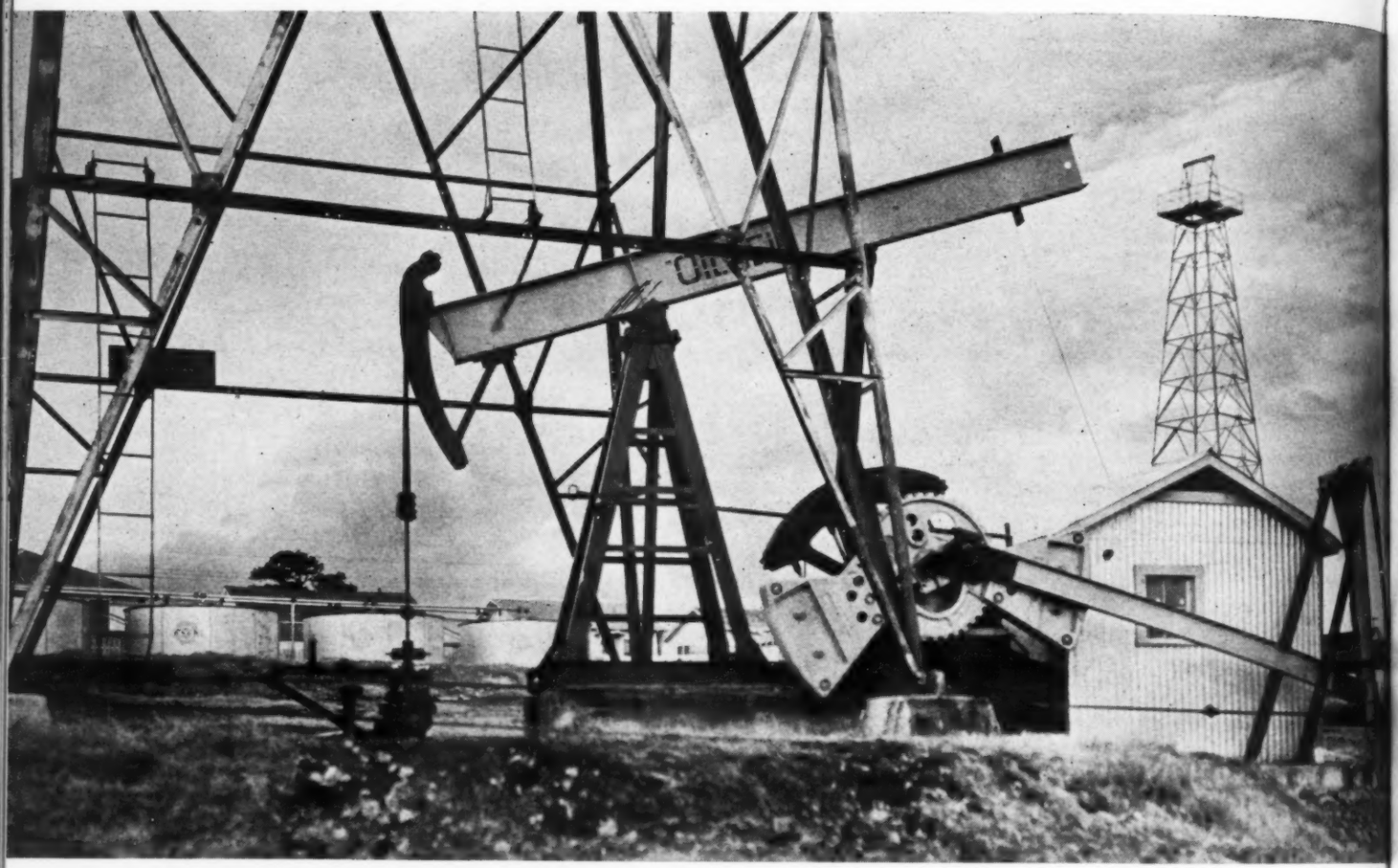
These latest-designed units approach as nearly as possible, both in performance and method of operation, the flexibility and performance of steam power. Drilling crews long accustomed to steam have found these units a highly satisfactory power plant for drilling in areas where local conditions preclude the use of steam.

As with rotary drilling, "Oilwell" has contributed better design, materials, and performance to cable-tool equipment, each improvement resulting in reduced drilling costs.



An "Oilwell" Franklin No. 3 Cable-Tool Drilling Unit drilling a deep test to the Oriskany Sand in Northwestern Pennsylvania

Production Equipment



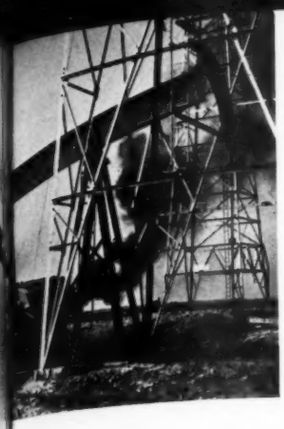
This "Oilwell" SC-27 Single-Crank Pumping Unit is in operation on a lease in East Texas pumping one well from the beam and two additional wells by means of a Wheel-Type Back Crank and a Pumping Pendulum

Pumping Units

DIAMOND JUBILEE 1887 OILWELL 1937 75 years of progress

FOR many years the equipment used for the mechanical lifting of oil from the well consisted of the walking beam, band wheel, and prime mover with belt drive of the same type as that used for cable-tool drilling. In fact, in many instances the cable-tool equipment was left at the well permanently for pumping it. The prime mover was used with the bull wheel or production hoist to pull rods and tubing. Due to lack of adequate transportation equipment that could move easily from well to well when rods and tubing required attention, there was no alternative but to have complete equipment at each well where the wells were pumped individually. Standard rigs were used by the thousands and construction and dimensional standards were adopted by the A.P.I. to provide adequate and interchangeable rig irons.

About 1930 the use of portable winch equipment was begun and along with it the development of the portable pumping units mounted on structural-steel skids and requiring no concrete foundation above ground. Today the installation of standard rigs for pumping is the exception and the transition to the portable pumping units now so popular has been justified fully by the greatly reduced cost of pumping equipment per well, higher efficiency, reduced



operating costs, simpler operation, and greater salvage value. The present-day portable pumping unit, consisting of samson post, reduction gear, and prime mover, all mounted on a structural-steel frame and placed on a single concrete mat or foundation, represents the ultimate in utility and efficiency for actuating a walking beam. Great progress has been made during the last several years in bringing this type of unit to its present state of perfection and "Oilwell" has taken a leading position in this respect.

The "Oilwell" line includes a complete range of sizes for all well conditions in both the single and twin-crank types. "Oilwell" introduced the first twin-crank construction in which there is a true equalization of the loads on the two pitmans. The design, which incorporates fully self-aligning bearings at both ends of the pitmans, was suggested by the parallel of a horse applying its pulling power to a vehicle through the horse collar, the traces, and the singletree. The construction is very simple and very old in principle and is the only way in which true equalization can be accomplished, thereby providing against unbalanced stresses in the working parts of the unit.

"Oilwell" pioneered the development of the fully-oilbath bearing in pumping units, jacks, etc., so superior to the open-type grease-lubricated bearings previously used on samson post and pitman. In the modern design, the oil is retained in the bearings by means of seals around the pins. The bearings run for many months without requiring additional oil or any other attention, and their service-life is increased greatly because they are completely weatherproof and also because oil is a better lubricating medium for this service than grease.

"Oilwell" Pumping Units are characterized by their sturdy four-legged derrick-type samson posts, which provide greatest strength and stability with minimum weight. All units are supplied with either the arc-and-cable type or the link-type of polished-rod hanger, in accordance with the preference of the user. The former, sometimes referred to as "horsehead" or "mulehead," has a positively straight lift, while the latter has more rigidity and strength to recommend it, at the expense, however, of requiring lubrication of a number of parts.

For many years "Oilwell" has been the exclusive oil-field distributor of Westinghouse-Nuttall speed reducers. Their design, comprising single-helical gears mounted on roller bearings and fitted in a weatherproof completely-enclosed oilbath case, has proved beyond any doubt their superiority for oil-field pumping over a long period. A complete range of sizes is available, all but the smallest of which have a double-extended low-speed shaft for use either as part of a twin-crank unit or a single-crank unit with back-crank equipment. All sizes are equipped with a hand brake on the high-speed shaft to assist in spacing the traveling member of the well pump. With either the electric-motor drive or the internal-combustion engine drive a remote control for operating the brake is provided at the point most convenient to the operator, so that in each instance only one man is required to space the pump in the well.

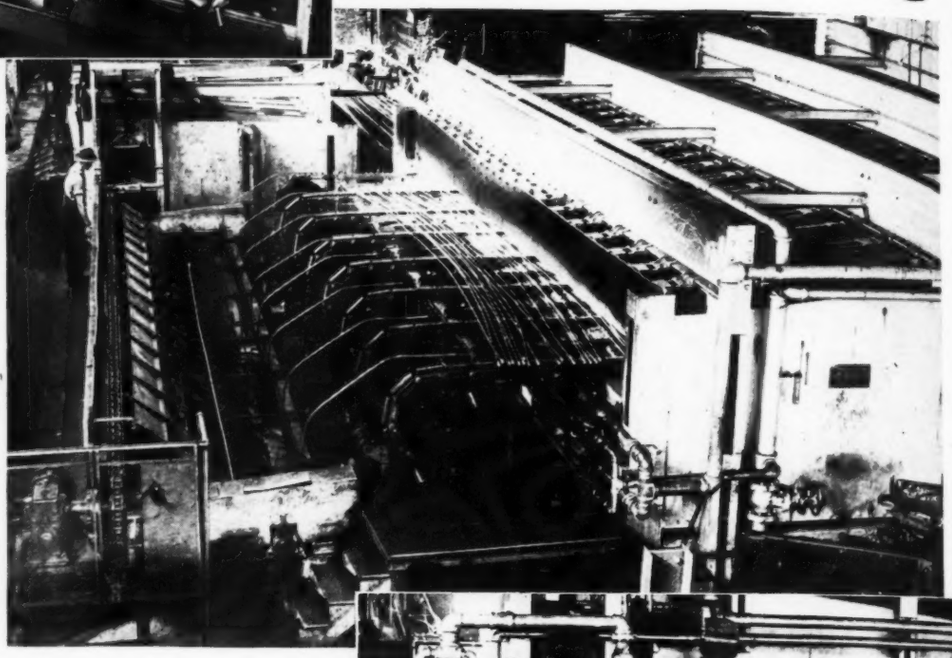
"Oilwell" has developed a very effective type of back-crank arrangement for pumping two or more wells from a single pumping unit. The back crank is of the disc type and is provided with three crank arms spaced at 90 deg., so that no matter in what direction the back-crank wells are placed the forces resulting from these wells may be properly timed to assist in counterbalancing the beam well of the pumping unit. The crank disc is designed for attaching movable counterbalance weights, which are used when necessary to correct unbalanced conditions resulting from the removal of any of the wells in the system. This provides the most flexible operating condition possible and prevents overloading the prime mover and speed reducer during part-time operation of the various wells in the system.

"Oilwell" Pumping Units are described and illustrated in the following bulletins:

No. 5 Single Crank	No. 136
No. 10 Single Crank	No. 121-A
"SC" Series Single Crank	No. 157
Twin Crank	No. 156

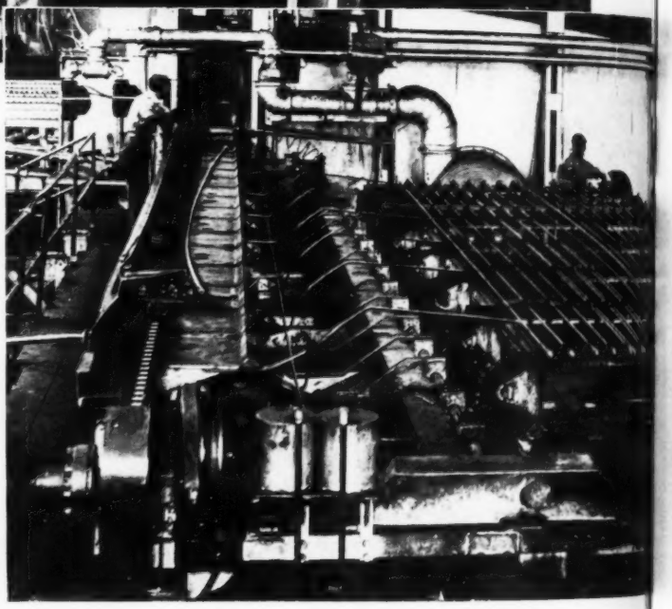
An "Oilwell" TC-27-C Twin-Crank Pumping Unit at Chase, Kansas

Sucker Rods & Pull Rods



NORMALIZED . . . Triple Heat-Treatment of "Oilwell" Rods begins in this pyrometer-controlled continuous-type furnace where the rods are normalized over their entire length

QUENCHED . . Following normalizing, the rods are reheated in this furnace and then are quenched over their entire length. Recording pyrometers precisely control the temperatures of both the steel and the quenching fluid



DRAWN . . . Finally, the rods are drawn at a uniform temperature from end to end over a prescribed period of time and are mechanically stretch-straightened and proof-tested at the drawing temperature

THE use of sucker rods for actuating the plunger or displacement member of a bottom-hole pump is almost as old as the oil industry itself. In the beginning the rods were made of wood and attached by various types of wrought-iron connecting fittings to form the full-length string. These served adequately for the original shallow wells, but loads soon became sufficiently heavy to create a demand for stronger, all-metal rods. The first rods of this type were made by hammer-welding to each end of a round bar the heavier sections required for threading externally and internally. "Oilwell" pioneered in the next logical step in the development of sucker rod manufacture —namely, upsetting the round bar to form the integral box-and-pin forgings — and continued as a leader in sucker-rod production throughout the many years following during which these rods satisfactorily met the service demanded of them. In the late twenties, however, the conditions became increasingly more severe and science and engineering became necessary in developing sucker-rod materials and production methods. "Oilwell" again took the lead when it pioneered the triple heat-treated carbon-steel sucker rod, thereby providing greatly-improved physical properties to cope with the heavier loads encountered in pumping deep wells. This development has been extended to include various alloy steels that were found necessary to counteract corrosive and embrittling well fluids.

Until a few years ago little was known about the causes of excessive sucker-rod breakage and the means necessary

to correct them. The physical limitations of tubing size prevented the usual procedure being followed—that of making the rods stronger by increasing their diameter to take care of increased stresses caused by greater well depths. In 1930 "Oilwell" engineers and metallurgists decided that the only reasonable course to pursue was to improve the physical properties of sucker rods by fully heat-treating (quenching and drawing) the rods after forging the ends. It was a rather simple decision to make considering the advantages already attained by the heat-treatment of steel parts in various other kinds of machinery, such as the automobile, etc., but the development of the methods and equipment necessary to produce sucker rods up to 30 ft. long that would be of uniform quality throughout the length of each rod or group of rods, was not so simple.

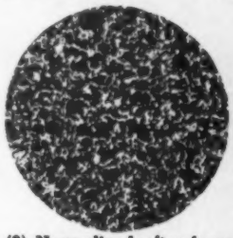
Being a pioneer undertaking it was a case of "creep before you walk." It was at first necessary to use the batch-type furnace for heating the rods to the quenching temperature and to remove manually each rod from the furnace individually. Then six or eight men with hand tongs spread out along the length of the hot, limber rod, would attempt to keep it reasonably straight as it entered the quenching bath. The natural result of this method of quenching was extremely crooked rods that had to be cold-straightened. A further unfavorable result was a noticeable lack of uniformity in the physical properties; nevertheless, despite these conditions, early field tests gave encouraging evidence that heat-treated sucker rods were superior. The next step in the development, then, was to devise ways and means of commercially producing fully heat-treated rods that would be straight and of uniform quality. The best methods and equipment were determined by trial and error, during many months of experimental work and finally in 1933 "Oilwell" installed the first complete furnace, with quenching, drawing, and straightening equipment for the manufacture of triple heat-treated sucker rods. The results obtained with this equipment in a short time proved so satisfactory, and the demand for the rods increased so rapidly, that soon it became necessary to treble the capacity of the equipment. Now "Oilwell" can produce almost 1,000,000 ft. of triple heat-treated sucker rods a month.

The heating, quenching, drawing, stretch-straightening, and proof-testing of "Oilwell" rods are done under the most accurately-controlled conditions possible. The entire heating area of the furnaces is automatically pyrometer-controlled. The furnaces are of the continuous type in which the rods are conveyed through the heating zone at a predetermined accurately-maintained rate, resulting in an absolutely uniform quenching temperature. The rods are handled mechanically into the quenching bath and restrained against undue distortion during the cooling. The duration of the quench and the temperature of the quenching bath are automatically controlled at all times, resulting in a uniform grain structure of the steel. The drawing heat is applied to the rods with the same type of furnace equipment and with the same exactness of control. After the rods have been held at the drawing temperature for the required time, they are mechanically placed in the stretch-straightening machine while at the drawing temperature and are stretched beyond the elastic limit of the steel at that temperature and a predetermined tension is maintained until the rods have cooled sufficiently. All the operations in this cycle are automatically controlled as regards time, tension, and temperature. It will be seen that the rods placed under tension for straightening while hot are simultaneously proof-tested for defects in the steel, non-uniform heating, and quenching cracks. If any such defects are present the rod will "neck down" or fracture at the weak point when stretched while hot.

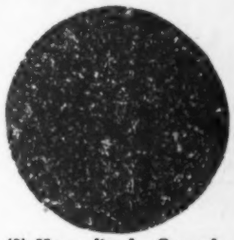
During the past several years the chemistry of well fluids and also the proper chemistry of steels suitable for use as sucker rods in well fluids containing hydrogen sulphide and other corrosive and embrittling constituents have been receiving much attention from oil producers and manufacturers. "Oilwell" has run hundreds of tests on many steels heat-treated in various ways to determine the endurance limit, the physical property that is one of the most important factors in sucker rod life. These tests have been made with the specimen submerged in actual well fluids, and also synthetic well fluids, from many different fields and of many different compositions. Determining what materials are best suited for such a wide variety of stresses and chemical conditions is a problem extensive in scope. The sucker rod, always highly stressed merely from the standpoint of well load, must be ductile, relatively hard to resist wear, and have a high resistance to impact to resist the shock loads and stress reversals encountered, and in many instances must maintain all these properties in the presence of active chemicals in the well fluid that tend to deteriorate the rod rapidly.

"Oilwell" is in a particularly favored position to find the solution to problems of this kind. In addition to its own extensive laboratory facilities, it has the facilities of the Carnegie-Illinois Steel Corporation and the National Tube Company, both of which are subsidiaries of the United States Steel Corporation, upon which to call for coöperation and assistance. These combined metallurgical facilities make it possible in the manufacture of "Oilwell" sucker rods to have complete control of the material from the ore mine to the consumer. This is extremely important to the user as it results in a superior product that many times has been developed especially for a particular service. In making special sucker-rod steels, it has been necessary in a number of instances to revise steel-furnace and rolling practice in order to obtain the desired results.

(1) As Forged



(2) Normalized after forging



(3) Normalized, Quenched, and Drawn after forging

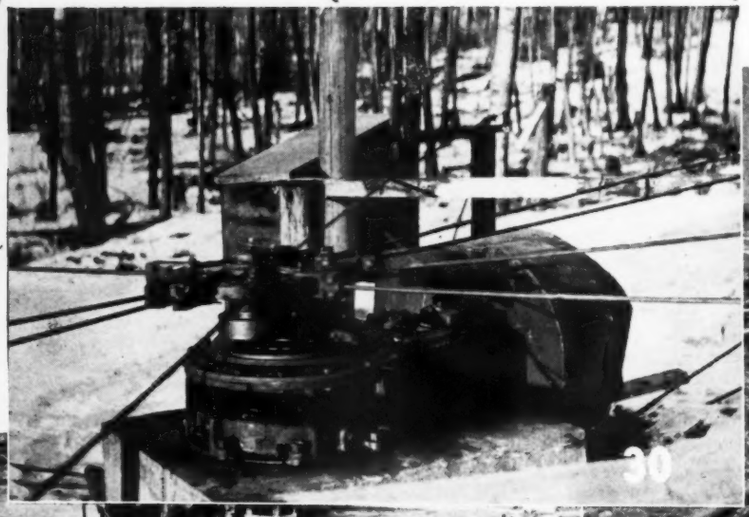
Above are three photomicrographs, each magnified 100-X, showing grain-size and structure of "Oilwell" SAE 1050 Sucker-Rod Steel (1) as Forged, (2) Normalized, and (3) "Triple Heat-Treated"

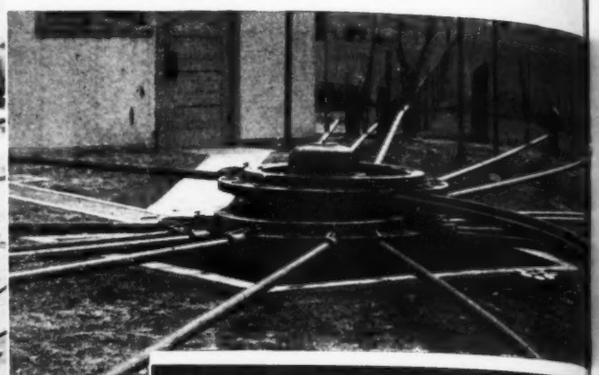
In all domestic fields, "Oilwell" maintains technically-trained representatives whose function is to analyze the various well conditions encountered and to assist the operators in the proper application of the various grades of sucker rods now available. These men are equipped with the latest types of dynamometers for measuring polished-rod loads and are trained to interpret the indicator cards taken by these instruments, with a view to correcting mechanical difficulties that often exist and that, if not corrected, result in greatly increased lifting costs. "Oilwell" pioneered fully heat-treated sucker rods and, by using its almost unlimited scientific and manufacturing facilities judiciously, has been able to bring to the present state of perfection several new grades of sucker rods.

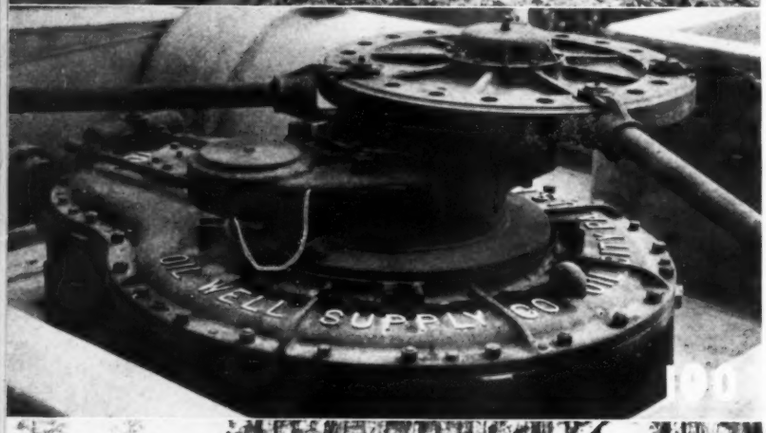
Following closely on the heels of triple heat-treated sucker rods, "Oilwell" developed triple heat-treated pull rods. The same equipment is used to produce pull rods and the advantages obtained by their high physical properties have revolutionized pull-rod applications. With heat-treated pull rods it is always possible to use at least the next smaller size rod, thereby reducing rod-line friction and decreasing original cost of the rod and also operating cost.

Information on the various grades of "Oilwell" sucker rods and pull rods is contained in Bulletin No. 128-B.

Geared Pumping Power







TYPICAL "OILWELL" GEARED POWER INSTALLA

30—No. 30-SC Power in Pennsylvania . . (Bulletin
50—No. 50 Power in Michigan . . . . . (Bulletin
80—No. 80-SC Power in Louisiana . . . . (Bulletin
100—No. 100-SC Power in West Texas . . . (Bulletin
150—No. 150-SC Power in East Texas . . . (Bulletin

THE group method is among the oldest methods of pumping oil wells. It was originated, quite naturally, because the early pumping wells were shallow and production limited, requiring little power input per well. Each well was equipped with a light pumping jack operated from a central power by a shackle line of wire rope, old sucker rods, or pull rods. As many as 40 wells frequently were attached to the power with the shackle lines running in all directions from the power location.

It is quite interesting to study old catalogs showing bandwheel powers, open-type geared powers, and the very light short-stroke pumping jacks, and to compare them with present-day central-power equipment. In certain old fields the light-duty equipment of early design is still in use, and, it must be admitted, is doing the work reasonably well. It is apparent, however, that engineers and designers of this type of production equipment did not keep pace with the gradually increasing requirements of central-pumping problems. Operators thus were led to the natural assumption that the central-power or group method of pumping wells was limited to shallow production. Not until about 1930 did heavy-duty powers and jacks begin to make their appearance and manufacturers make a concerted effort to demonstrate the definite savings to be realized by pumping deeper wells with central-power equipment.

Believing that construction of a heavy-duty geared pumping power was justified by the need for equipment of large capacity not met by bandwheel powers or other equipment then available, "Oilwell" constructed the first completely-enclosed, roller-bearing, double-reduction gear-driven central pumping power about seven years ago. Today "Oilwell's" line of fully-enclosed geared powers includes 30-hp., 50-hp., 80-hp., 100-hp., and 150-hp. sizes (nominal ratings), by far the most complete on the market. The larger sizes, with jacks and other "Oilwell" surface equipment of comparatively heavy-duty construction are capable of pumping groups of wells of 4500-ft. depth and having polished-rod loads as high as 20,000 pounds.

The competent engineering and field staffs of many major oil companies have made studies during the last five years

to ascertain the most economical pumping methods. As a result they have installed geared powers in preference to other types of mechanical lifting equipment on many producing properties, even in deep fields. Numerous independent operators also are using this new type central-pumping equipment to reduce lifting costs. Having completed more than five years of successful field service, the modern geared power is now generally accepted by those operators who at first were unwilling to believe that deep wells could be pumped satisfactorily in groups, and also by those who for many years adhered to the bandwheel central pumping power.

The modern geared power as made by "Oilwell" has distinct construction and operating advantages over the bandwheel type. These include greatly-reduced housing costs, lower installed cost, less blind-angle, more convenient height of pull-rods, higher mechanical efficiency, reduced upkeep, greater reliability, and a wider choice of prime movers and drives.

As it is of fully-enclosed weatherproof construction, the modern geared power can be set entirely in the open and requires housing for only the prime mover and the short V-belt drive that generally is used. Thus the lower housing expense and also, to a large extent, the lower installed cost and reduced blind-angle. In some installations the geared power is direct-connected to the prime mover, thus further reducing housing expense and entirely eliminating it where weatherproof motors are used. Setting the power in a pit permits lowering the rod lines to the desired height above ground for greatest convenience and efficiency. The wide choice of prime movers and drives, and the complete range of geared-power sizes, enable the operator to select equipment that will assure maximum overall economy for his particular operating conditions.

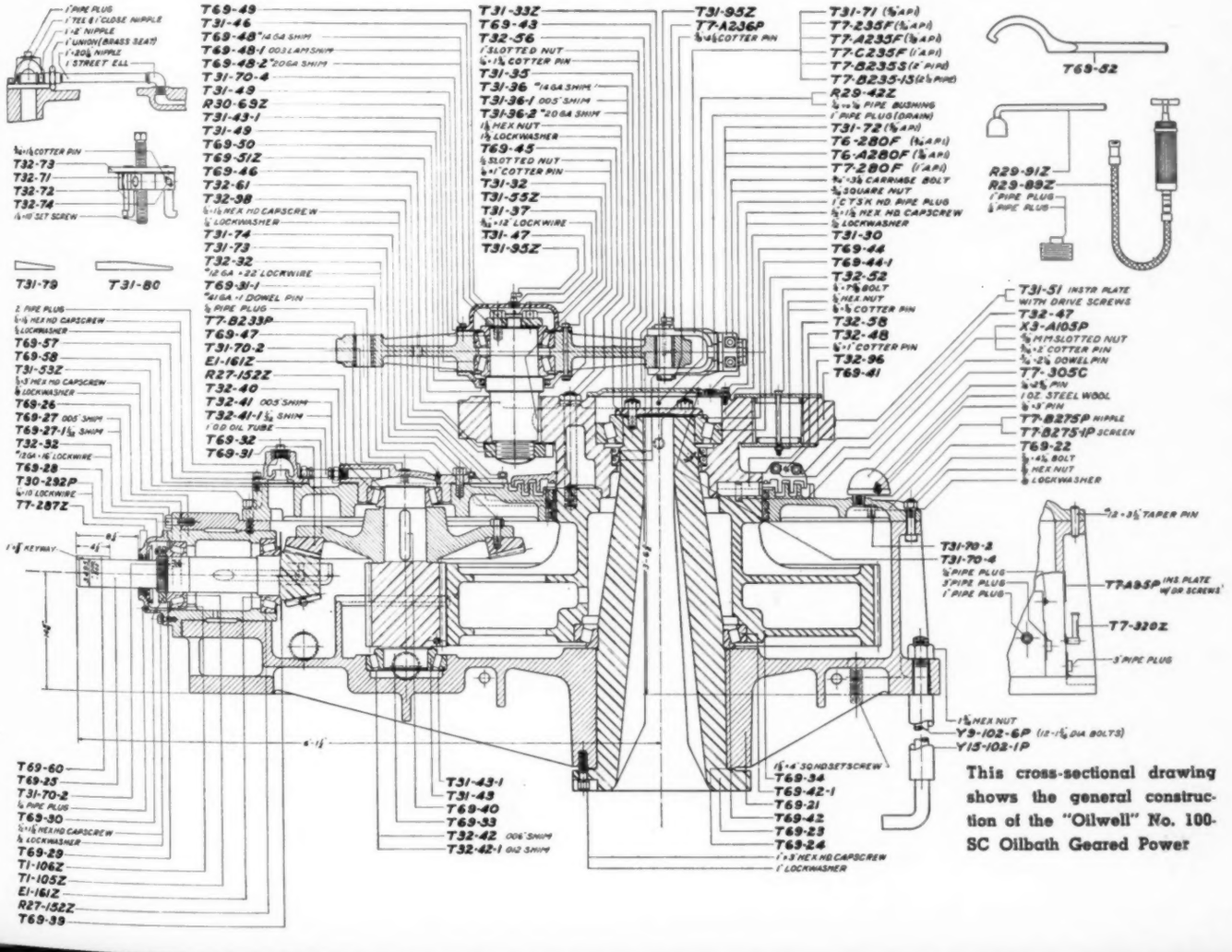
The compact construction of "Oilwell" geared powers, illustrated by the cross-sectional drawing of the No. 100-SC, results in high mechanical efficiency, low upkeep, and utmost reliability. All gears are precision-cut and heat-treated to insure ample strength and excellent wearing characteristics. The revolving parts are mounted in heavy-duty roller bearings. Ample lubrication of all gears and bearings is assured at all operating speeds. The materials are of the best quality and workmanship is of the highest standard.

The first geared powers of modern design used eccentrics for actuating the pull rods. Although this construction has certain advantages when two eccentrics are required for pumping a large group of shallow wells, the crank type is now more popular and more widely used. It is easily made weatherproof and is more suitable than the eccentric type in the larger sizes, which encounter long strokes and heavy pull-rod loads. Except for one power of relatively small size, the "Oilwell" line is now made up entirely of the crank type.

"Oilwell" crank-type powers are provided in most sizes with a choice of two strokes, this feature being made possible by the stationary-spindle construction for which "Oilwell" geared powers are well known. The stationary spindle for carrying the rotating parts is considered superior to the revolving-shaft type of construction, as all side pull is transferred directly to the base and the foundation rather than to the base cover and thence through the base-to-cover joint to the base and foundation.

The "Oilwell" stationary-spindle construction also provides a more favorable bearing spacing between the crank pin and the upper spindle bearing and between the upper and lower spindle bearings. It is important where the overhung-crank type of drive is used that the main spindle bearing, which must take directly all the lateral force applied to the crank pin, be as close as possible to the line of these lateral forces. This is true in the stationary-spindle construction.

"Oilwell" geared powers have proved their merit in all sizes over a period of years of field operation. Repeat orders in increasing numbers speak volumes for their satisfactory, economical, and efficient operation under the most severe conditions of operation in all fields where the group method of pumping oil wells is practiced.



This cross-sectional drawing shows the general construction of the "Oilwell" No. 100-SC Oilbath Geared Power

The heavy-duty pumping jack at the left is the "Oilwell" No. 16. The "Oilwell" Wheel-Type Counterbalanced Back Crank and the Pumping Pendulums shown above provide a hookup for pumping 4 wells with one geared speed reducer

Pumping Jacks & Other Surface Equipment

THE evolution of the pumping jack with regard to design, construction, and capacity is much the same as that of the central pumping power. In the early days jacks were constructed entirely of wood, later of pipe; today they are of heavy structural steel. Modern welding practice has played a large part in the improved fabrication of heavy-duty jacks. All modern designs are of the underpull type as compared with the old overpull or Oklahoma type of light-duty jack.

In the "Oilwell" design particular attention is paid to ease and accuracy of assembly in the field, rigidity without excess weight, and ample bearing capacity with effective lubrication. The jack frame is made in halves, each fabricated independently, and with the two-piece top casting machined and fitted with dowel pins before welding to the side members. This construction provides a fully-machined surface for the saddle bearings after assembly and full utilization of the saddle-bearing capacity as a result of perfect alignment of the bearings.

By using an unique spread-leg construction of the legs, which face the power and resist the rod-line pull, the "Oilwell" design eliminates the need for side braces with attendant additional weight and assembly complications. This construction provides ample rigidity, simplifies the construction of the foundation, and gives added working clearance around the tubing head for running rods and tubing.

The saddle bearings and pull-rod bearings are of fully-enclosed oil-sealed weatherproof construction and are fitted with renewable bronze bushings. The bearings are of large size, and have conservative unit bearing pressures at the nominal rating of the jack. Either an arc-and-cable type or link-type rod hanger is supplied as desired. Adjustment for a wide range of polished-rod strokes is possible with any given pull-rod stroke.

With the introduction of the practice of pumping deep wells from central powers the design of the heavy-duty pumping jack becomes of paramount importance to the operator. The "Oilwell" No. 16 and No. 12 jacks, having polished-rod capacities of 16,000 lb. and 12,000 lb., respectively, have been in operation for several years in the field under the most severe operating conditions, and have met the demands made on them most successfully.

The other surface equipment used in pumping deep wells by central power has required completely new designs of greater efficiency and capacity. The hold-ups, hold-downs, knock-off posts, pull rods, and back-crank equipment, of which there are now many different types and makes available, have received the careful attention of the manufacturers in order to eliminate any weak link on the line of transmission from the power to the well. This engineering effort has resulted in a multitude of designs and constructions. Though it is natural that certain types are more economical and efficient than others, all are modern as regards materials used, effective lubrication, and ruggedness.

"Oilwell's" complete line of surface equipment includes practically all items needed to run a rod line under any conceivable condition. This equipment has been in field service for a period of years with eminent satisfaction. Back-crank pumping from pumping units and rig fronts presents the same rod-line problems as central-power pumping, and the equipment used is of the same type except that a pendulum and pitman is employed to actuate the rod line. The "Oilwell" Wheel-type Back Crank, which must be considered as part of the necessary equipment, was designed particularly to meet the various back-crank pumping conditions of jack-well locations with respect to unit-well location. By providing the wheel-type back crank with three crank arms spaced 90 deg. apart and with counterbalance weights that can be placed at any desired positions on the circumference of the disc, jack wells can be pumped independently or in any desired combination under proper conditions of balance to protect the prime mover and speed-reducing mechanism against undue shock loads and excessive peak torque.

Specifications covering "Oilwell" No. 12 and No. 16 Pumping Jacks are given in Bulletin No. 118.

Methods of Secondary Recovery Repressuring

OIL recovered by natural means from a producing sand quite often is only a small part of the total oil in that sand. Production declines as the natural energy that drives the oil into the hole diminishes. When the natural energy is insufficient to move the oil through the formation to the well, production ceases. In the older fields of Kansas, Oklahoma, and those included in and adjacent to the Pennsylvania or Appalachian fields, oil in large quantity remains in the sand even after production ceases from lack of sufficient natural energy in the sand.

In other eastern and western fields, the natural forces are declining and production eventually will reach a point where wells no longer can be pumped profitably. There still will remain in the formations immense quantities of oil, however, part of which can be recovered by some method of secondary recovery. The problem of secondary recovery is to restore energy to the producing sands and thus produce an artificial driving force that will move the oil toward the drilled hole, from which it may be pumped. Secondary-recovery methods depend on a means of re-energizing these reservoirs so that maximum recovery commensurate with profitable operations may be obtained.

Characteristics Of Producing Sands

In appearance, producing formations usually resemble soft or semi-hard rocks, yet there are microscopic cavities connected by tortuous passages that hold the oil, and from which it can be driven by natural or artificial force effectively applied. Producing sands have three characteristics that are important in determining the amount of oil that may be brought to the surface, namely: porosity, permeability, and saturation. Porosity is a measure of the number of cavities or openings that exist in the sand and in which the oil may be trapped. Permeability is a measure of the extent to which the cavities or openings, connected one with another by devious passages, resist the flow of fluids through them. Certain sands may be so closely bonded, or "tight," that it is impossible to produce oil by artificial methods. In such instances, the permeability is not favorable for employing secondary recovery methods. Saturation is a measure of the amount of oil present in the cavities. Other physical aspects also are important. For example, a shale break or a thin streak no thicker than a sheet of paper may effectively shut off the natural or artificial driving force such as air, gas, or water, regardless of the pressure behind it.

Water-Flooding

When considering repressuring, three pertinent questions arise: (1) How much oil is present? (2) What percentage of it may be recovered? (3) If in commercial quantities, what is the best method of restoring energy to the producing sand to move the oil?

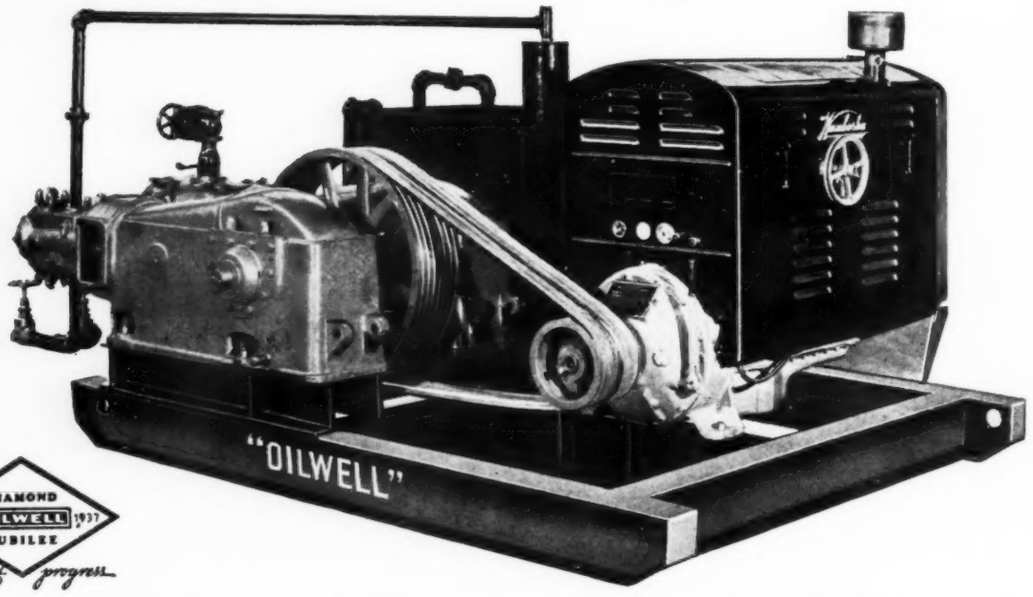
One method of producing an artificial driving force in the sand is by pumping water into the sand under pressure. This method of repressuring the sand is known as water-flooding and has reached its highest stage of development in the Bradford field. Here the sands are favorable for water-flooding and repressuring by this method has been very profitable, but it is significant that those who have made use of technical research and utilized modern machinery and equipment have profited most.

Power-driven reciprocating pumps of two types are now being employed in water-flooding service. The vertical triplex single-acting plunger pump of A-frame construction with plain bearings has been most widely used in the past. A more recent development is the horizontal duplex double-acting outside-end-packed plunger pump, introduced by "Oilwell" for this service and built at the Wilson-Snyder plant. This pump is equipped with a special pulsation dampener, which steadies the pump discharge, so desirable for this service, and embodies many refinements based on years of manufacturing experience and a careful analysis of operating requirements. The power end is of fully-enclosed all-roller-bearing construction such as is used for heavy-duty slush-pump service.

Operators experienced in water-flooding practices recognize that high operating efficiency and low power costs over a period of years go hand in hand with equipment of skilled design, best quality materials, and fine workmanship. For continuous heavy-duty high-pressure pumping, the greatest economy results from the use of high-grade pumps designed

A water-flood pumping plant in the Bradford, Pennsylvania, field. The pump, which is seen in the background at the left, is a Wilson-Snyder "Represso" (3-in. by 12-in.) Double-Acting Plunger-Type Pump of horizontal duplex construction

Testing oil sands with an "Oilwell" Portable Repressuring Test Unit in an old field in the Pennsylvania Grade Crude Oil Region



The "Oilwell" Portable Repressuring Test Unit comprises an engine, a two-stage compressor, and a cooling-water tank all mounted on a rigid structural-steel skid-type base

DIAMOND 1862 OILWELL 1937 JUBILEE
75 years of progress

for the job. Power pumps built at "Oilwell's" Wilson-Snyder plant are particularly well adapted to this exacting service.

Reciprocating pumps employed for water-flooding in some instances are direct-connected to single-cylinder internal-combustion engines and in other instances are driven by electric motors or internal-combustion engines by means of V-belts.

Great care is used in the design and operation of water-flood pumping plants to assure continuous operation, accurate control of operating pressures, and the elimination of all solids from the water before it is introduced into the well. Actual water-flooding practice dates back about 20 years and much has been learned concerning the proper methods for obtaining best results. Much laboratory work has been done in determining sand characteristics and their adaptability to water-flooding by Pennsylvania State College and by others interested in the problem. In the old eastern fields many an abandoned lease has been revived to such a degree that the total secondary recovery of oil has exceeded that previously recovered by natural methods.

Testing Sands For Repressuring

Two very recent developments in repressuring operations are highly significant. (1), At least two major producing companies in the Pennsylvania area vitally interested in secondary-recovery methods, have developed special packing equipment to test the physical characteristics of the sand in the well at short intervals throughout the entire depth of the sand. It is expected that these methods will give an accurate index of the volume-pressure requirements. Horizontal layers of sand that prove unsuitable for repressuring may be packed off and the driving force effectively applied where it will produce the best results. (2), A group of producers who have full access to secondary-recovery data, made available through laboratory oil research, are giving favorable consideration to field-testing equipment that will determine the suitability of sands for secondary-recovery operations. These developments indicate a trend toward, and a preference for, practical field tests to determine the adaptability of oil reservoirs for repressuring operations.

Repressuring with Gas or Air

For a number of years in a few oil fields the practice has been to return under pressure to the producing sands the gas produced with the oil, thus maintaining the rock or reservoir pressure, which under ordinary methods eventually is dissipated. This cannot truly be called a secondary-recovery method because primary recovery has not ceased, but it is interesting to note that in some oil fields, particularly in the east, repressuring with gas or air lately has come into popular use for reviving oil wells in which the natural gas energy has been depleted. The general principle of repressuring with gas is the same as that of water-flooding and is adaptable to certain types of formation not suitable for water-flooding.

"Oilwell" early recognized that important developments were pending in repressuring operations and took immediate steps to train and prepare its engineers to become expert in the knowledge of secondary-recovery operations. Repressuring operations in the eastern states, including the Bradford-Allegheny and Titusville-Oil City areas in Pennsylvania, in fields in and around Charleston, West Virginia, Kentucky and Illinois, and also in some of the older western fields, have given these men a wide knowledge of operating practices and equipment. They are qualified to assist in many ways,

including preliminary field testing, making engineering surveys, and installing permanent repressuring equipment.

Portable Field-Testing Equipment

"Oilwell" has pioneered in the development of portable field-testing equipment for gas and air repressuring and builds the "Oilwell" Portable Repressuring Test Unit, which is easy to transport and install, and can be operated in the open. This unit provides the means for testing several wells on a lease with equipment that duplicates the operating conditions of a permanent installation. It is quite flexible and is designed so as to give all practical combinations of volume and pressure required for test purposes. The operator may change these combinations from time to time during the test and thus determine by actual experience the conditions best suited for maximum recovery. He makes no permanent installation until tangible results definitely have proved the merit of the property for repressuring purposes.

Usually a test of 30, 60, or 90 days is sufficient to determine the practicability of permanent repressuring operations. These units are available at a nominal rental fee so that a thoroughly practical test may be obtained at reasonable expense, and, from the results, reliable specifications for a permanent installation may be developed. The test unit is delivered ready to operate. No foundations are required; just as soon as the well piping connections are made the unit may be operated. There need be no expensive installation delays to add to the rental expense.

The success of any permanent repressuring installation hinges on properly controlling the directions of the energy supplied at the input wells. Frequently, sands showing large quantities of oil have yielded little because of the improper application of energy. Where sands are not of uniform texture, steps must be taken to avoid channeling or by-passing of the applied driving force. Misapplied energy is a waste of power and fuel and results in a cash loss and increased operating cost. Operators should realize that operating procedure carefully planned, that pays strict attention to surface and subsurface details, will bring maximum results.

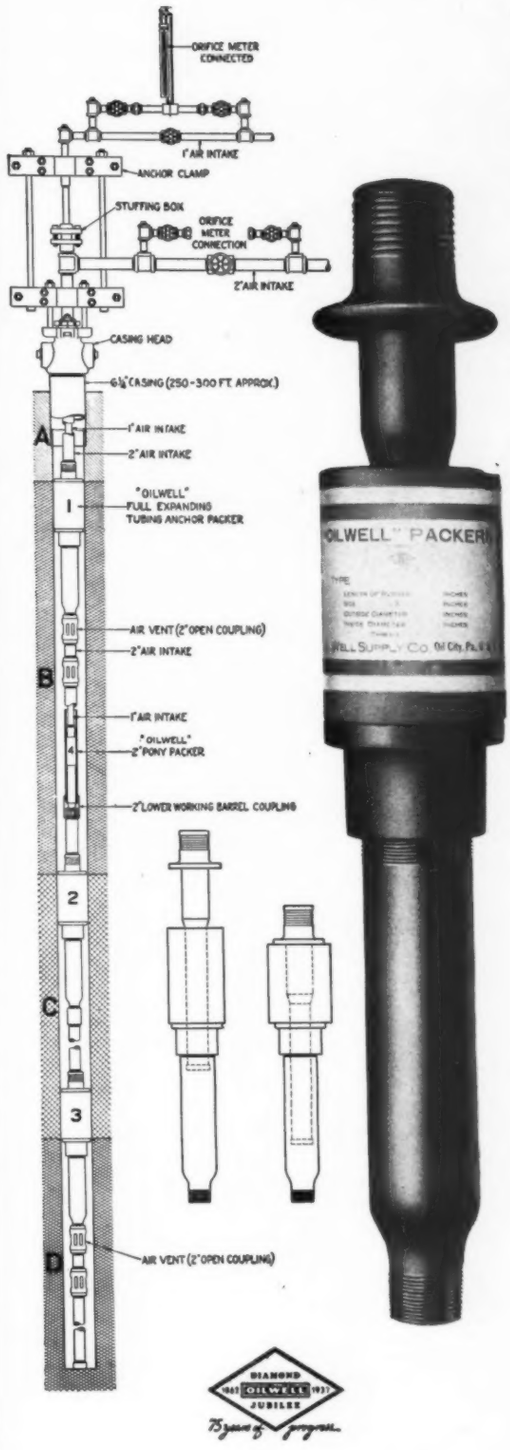
More complete information regarding the "Oilwell" Portable Repressuring Test Unit is given in "Oilwell" Bulletin No. 151.

Packers

A vital factor in the success of repressuring operations is the ability to confine the air, gas, or water in the input wells to the productive sand or that portion of it which by test has proved most suitable for repressuring. Packers of special design have been developed for this purpose. They effectively confine the repressuring medium to the productive portion of the sand and at the same time prevent extraneous subsurface well water from entering the productive sands.

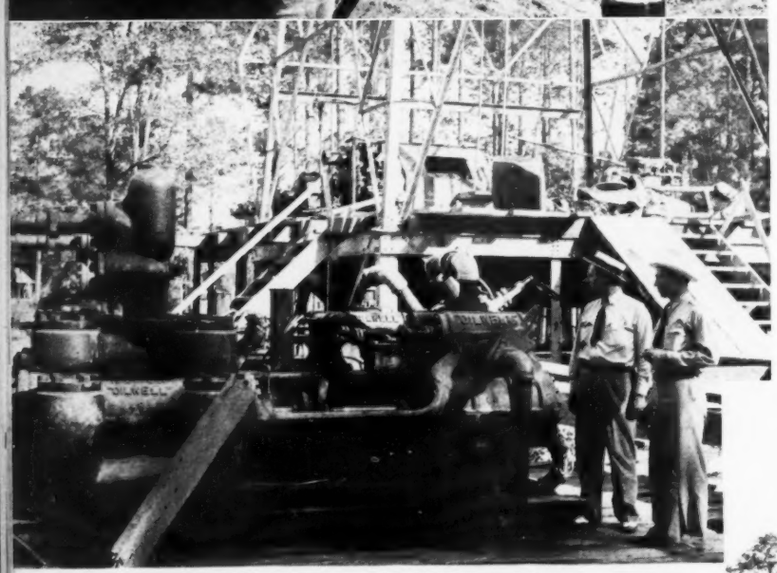
Packers of other types and designs are employed for drilling and production operations. A knowledge of their functional utility and application to many well problems saves an investment in casing and other more expensive equipment. Frequently they are employed to control and extend the natural flow of producing wells. They are of great economic and practical value when reconditioning old wells having leaky casing or tubing. The savings made possible by their many applications save operators thousands of dollars each year.

"Oilwell" manufactures a very complete line of packers of many different types and sizes. A separate manufacturing plant at Bradford, Pennsylvania, is devoted to the development and construction of packers for all well conditions . . . only the best quality materials are used and workmanship is held to the highest standards.



The drawing on the left shows a well arrangement used for repressuring two sands. "Oilwell" Full-Expanding Tubing Anchor Packers like the one illustrated at the right are used in the positions indicated by the numerals "1", "2", and "3"

"Oilwell" FIELD SERVICE



The pictures on this page show "Oilwell" field engineers assisting customers in the installation of new machinery and equipment.

FIELD stores obviously are a necessity to both the user and the manufacturer of oil-field equipment. "Oilwell's" field stores are more than mere depots where merchandise is stocked to meet customer demand. They are the field headquarters for engineering service offered by "Oilwell" to the users of its equipment. Sales engineers and service men are especially trained to perform this work. It is the duty of these men to see that each piece of equipment sold performs in accordance with the requirements for which it was recommended and to supply the user full instructions regarding the operation of the equipment to obtain the greatest economy and efficiency. These trained engineers and mechanics also are of great assistance to the operator in determining in advance the type and size equipment that most satisfactorily will solve the problem at hand.

"Oilwell's" sales engineers and service men are in close contact at all times with the design department of the company, so that new requirements may be analyzed and provision made to meet them promptly. Through this channel the various ideas and suggestions of the operators also are transmitted to "Oilwell's" engineering department.

"Oilwell" considers the functions of these field engineers a vitally important factor contributing to its success as a leading manufacturer and supplier of oil-field equipment. "Oilwell" invites its customers to use its engineering facilities to the utmost for obtaining lower costs per foot of hole drilled and per barrel of oil produced.

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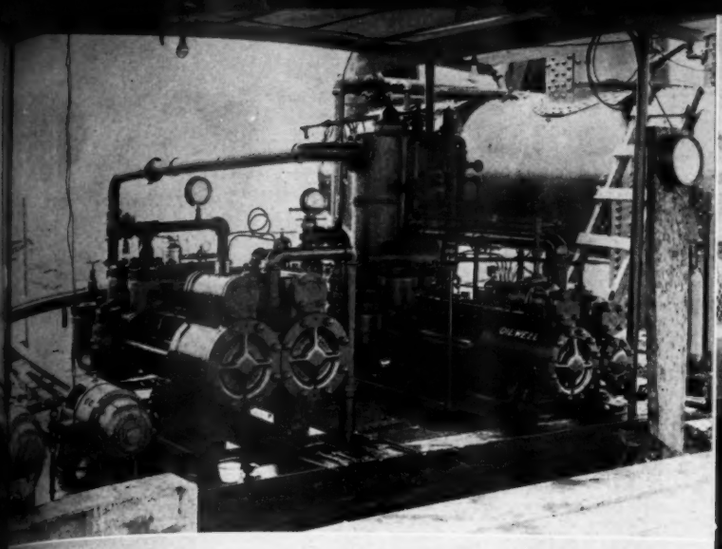
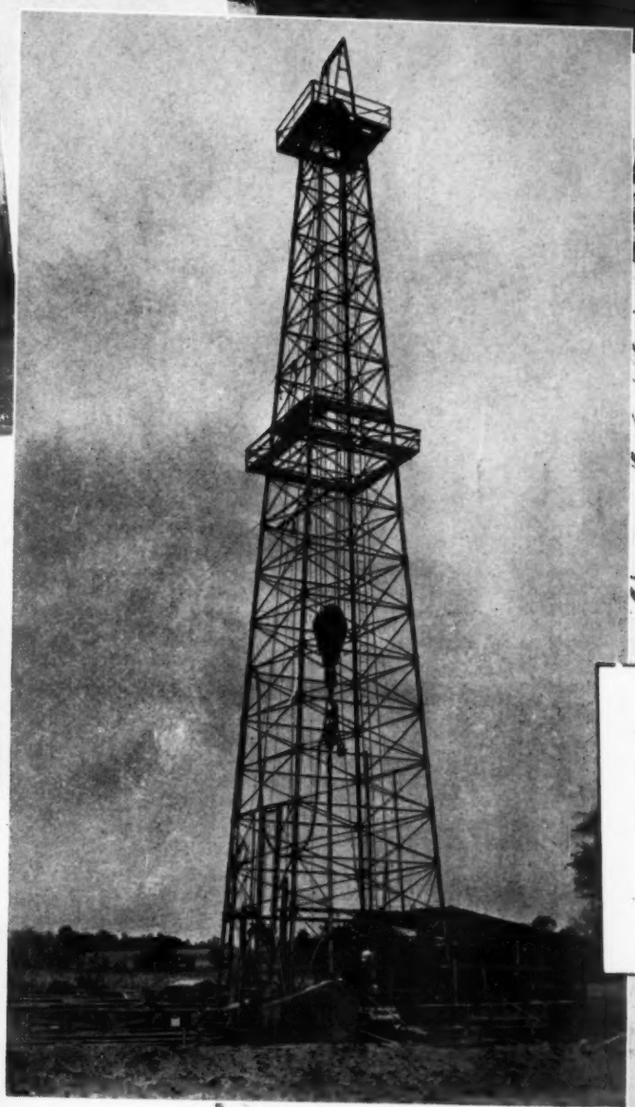
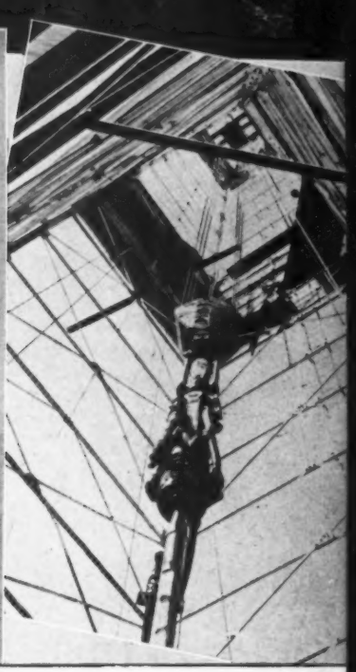
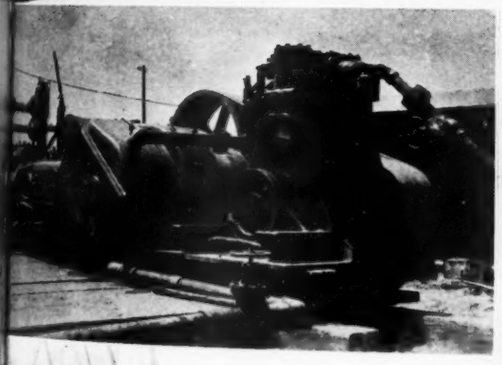
75 years of progress

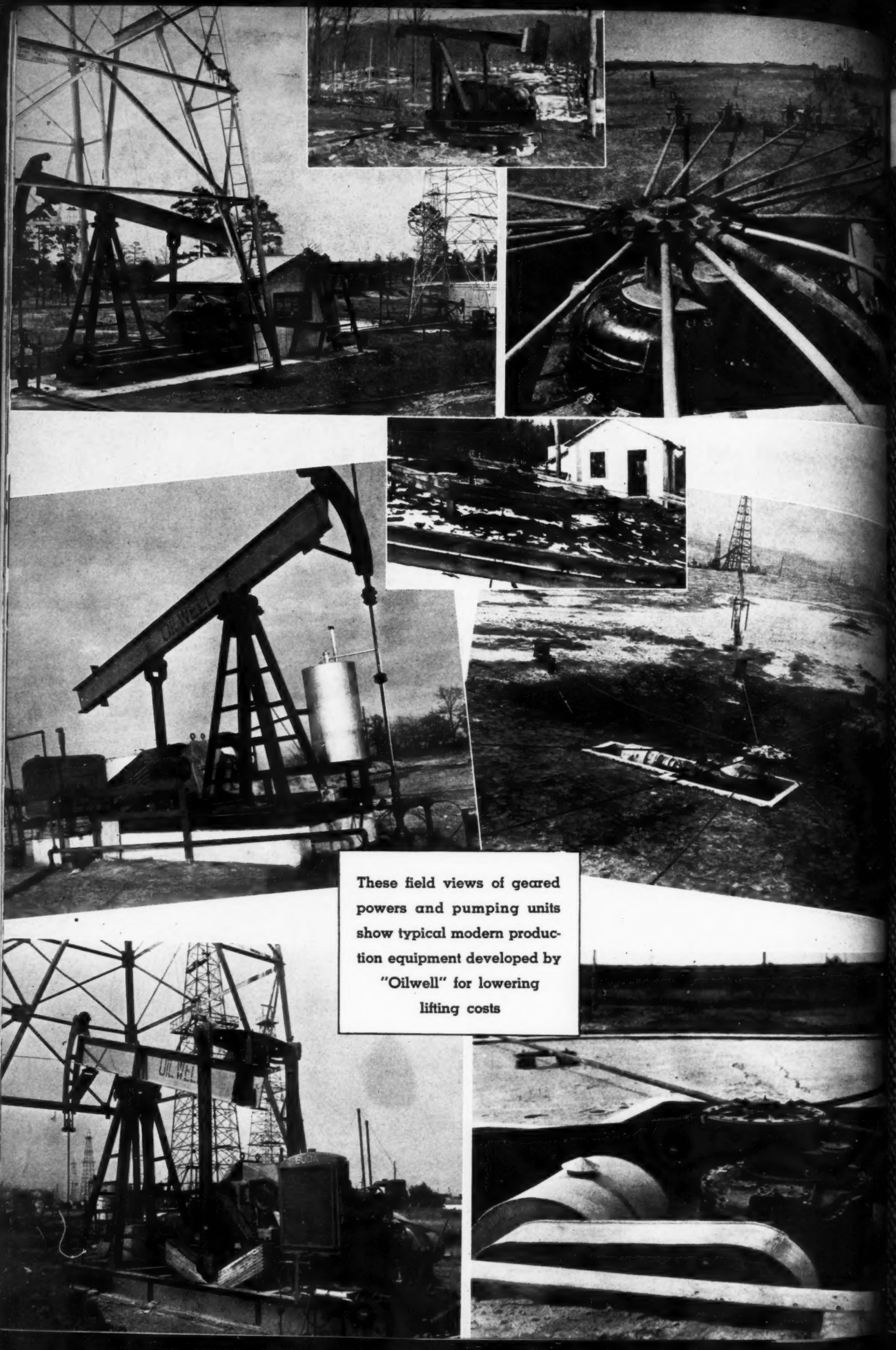






A cross-section of modern drilling equipment pioneered by "Oilwell" is shown by these views from widely scattered oil fields

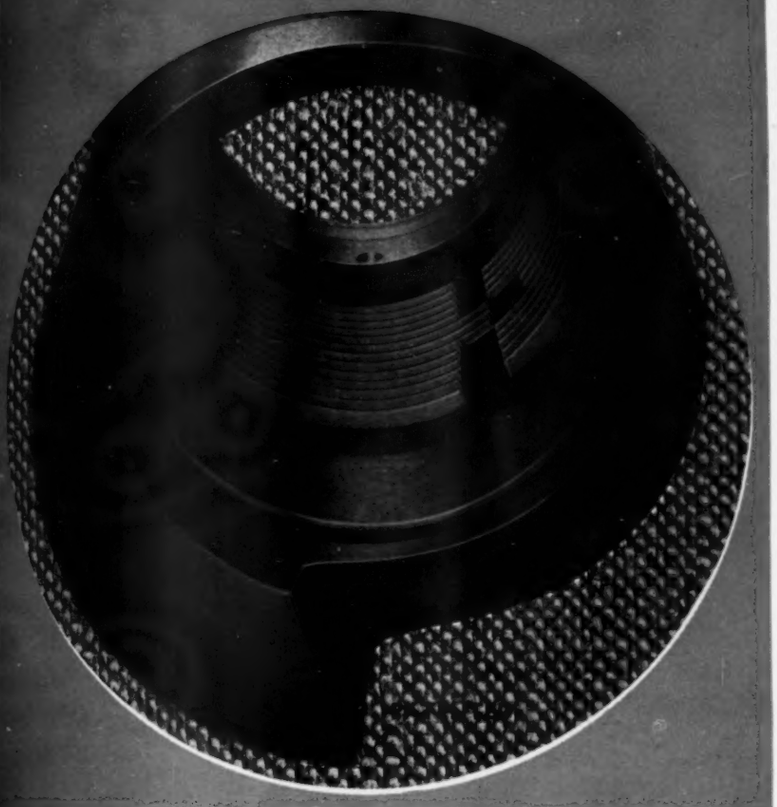




These field views of geared powers and pumping units show typical modern production equipment developed by "Oilwell" for lowering lifting costs

SLUSH PUMP OPERATED

OVERSHOT



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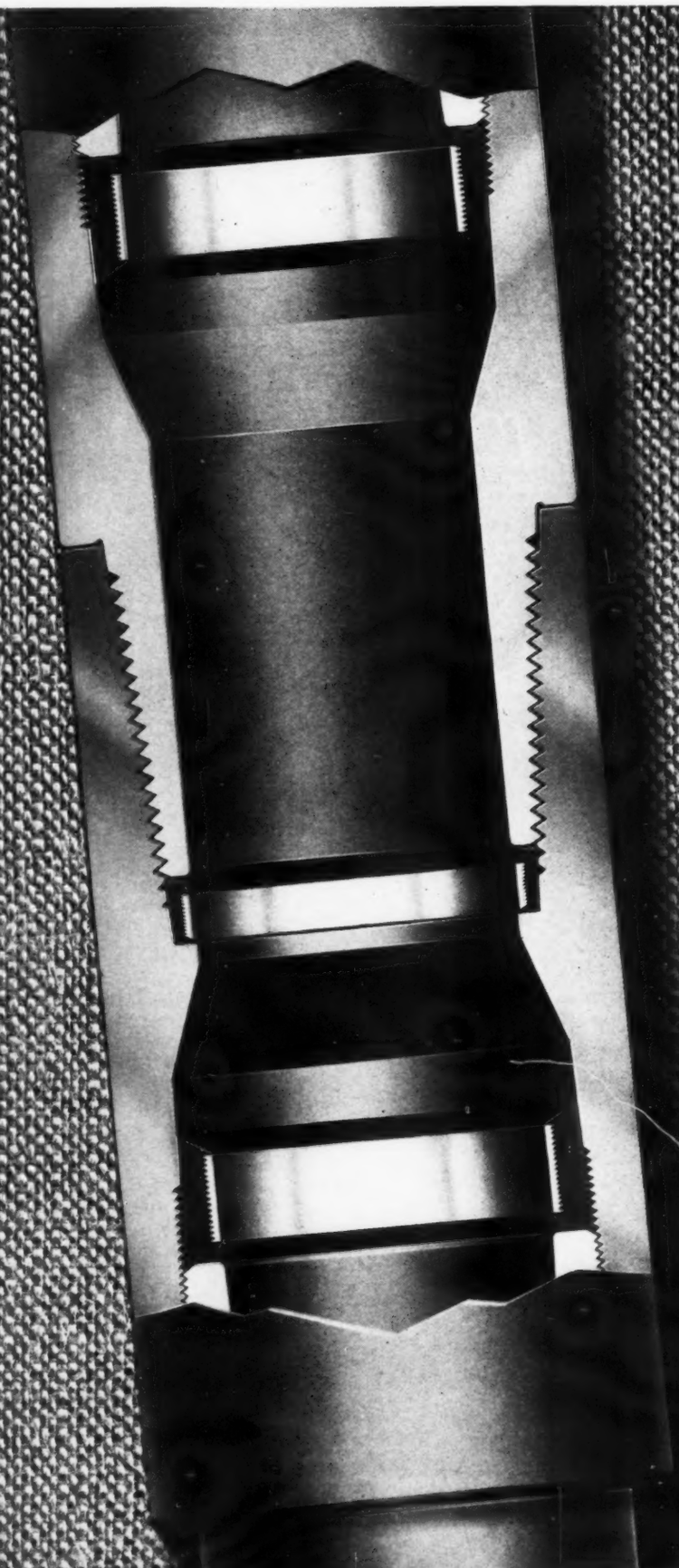
HINDERLITER



ROTARY PACK-OFF TOOL JOINT

Patented

Hinderliter was first to design and manufacture a rotary pack-off tool joint. This is the rotary tool joint that does not require a change of position of the swivel to prevent the drill pipe from turning, thus eliminating the expense and inconvenience of purchasing additional kelly tool joints.

Rotary drill pipe and tool joints are subjected to abnormal wear because of the abrasive cleaning of the hole by the rubber packoff seal. By providing salvage of tool joints worn out in drill pipe.

Guaranteed against thread leaks from mostly called washouts.

When your tool joint problems are so difficult that outside suggestions are necessary, consult Hinderliter Tool Company.

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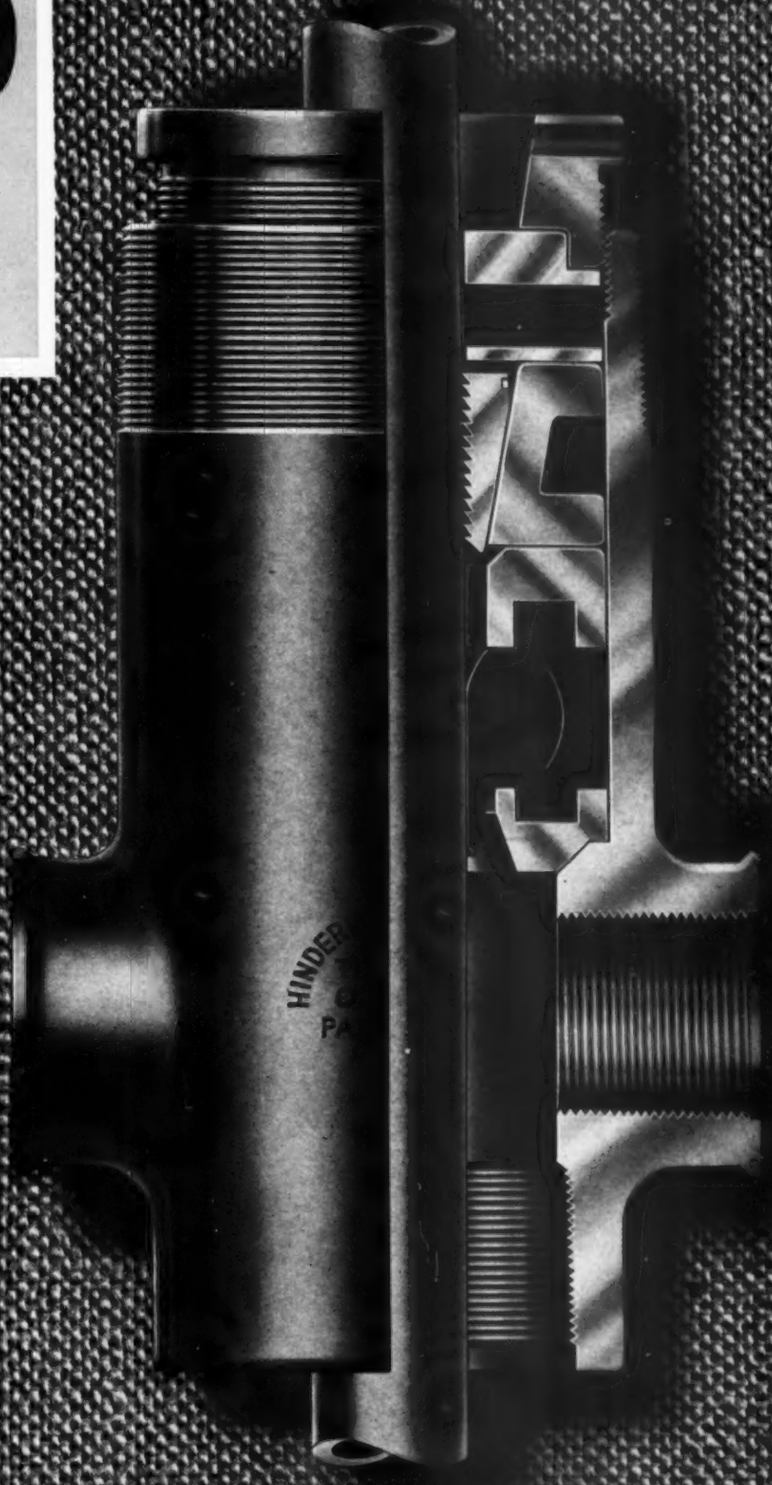
THREE-IN-ONE

CASING HEAD HOOK-UPS

Patented



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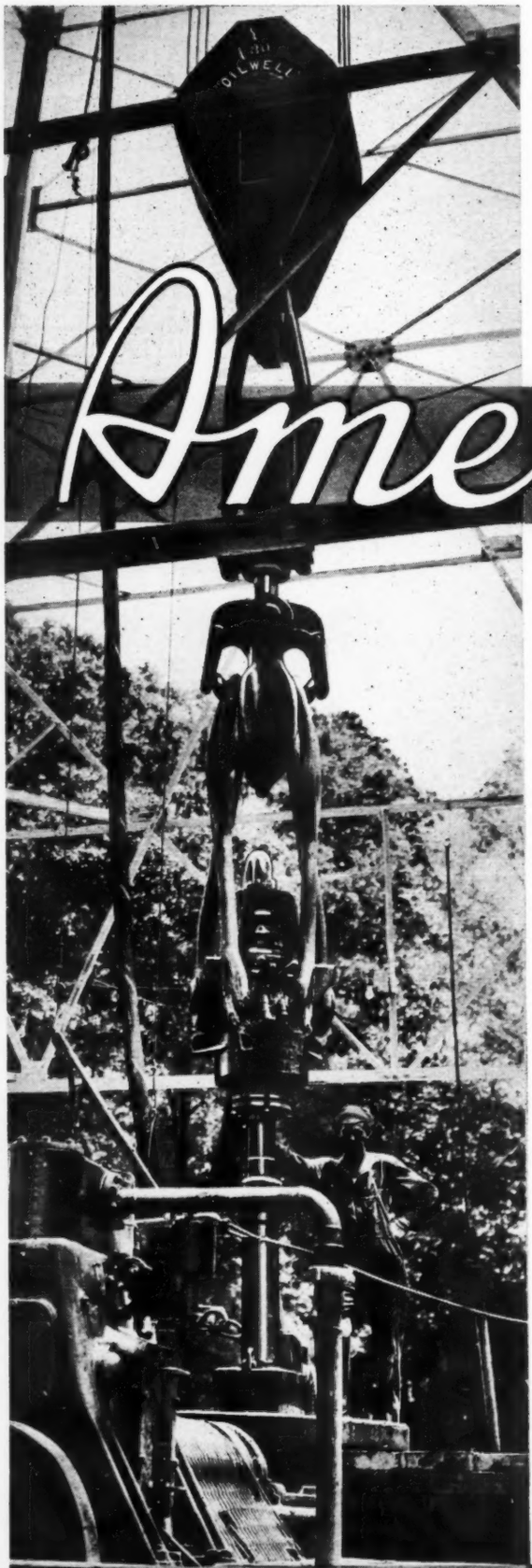

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OILWELL
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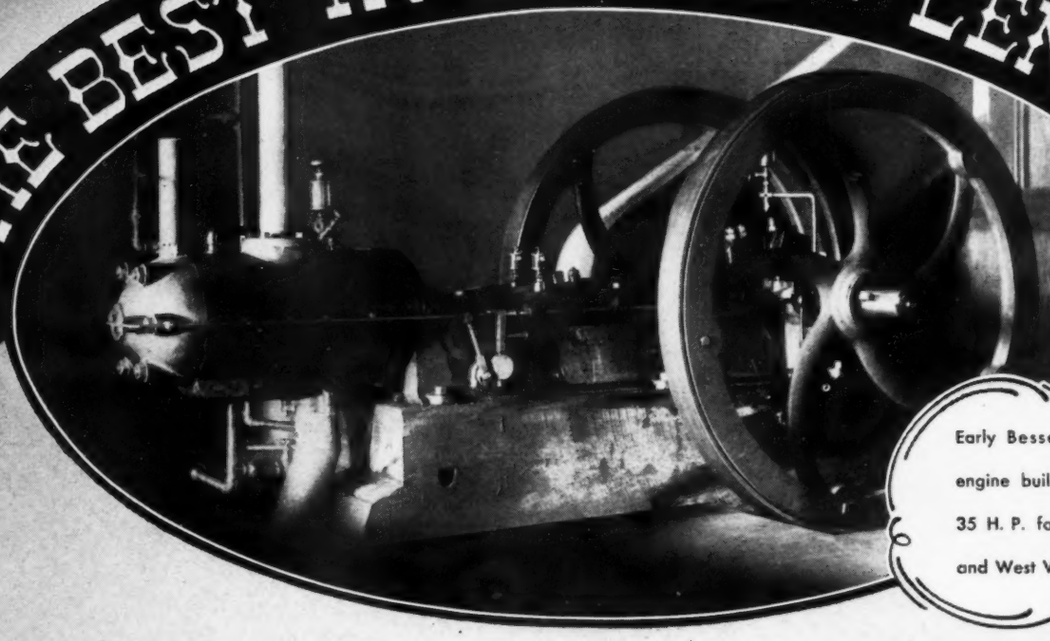
ROLLER BEARINGS

Machinery and Engine Builders Since the Year 18

THE BEST IN THE 19th CENTURY



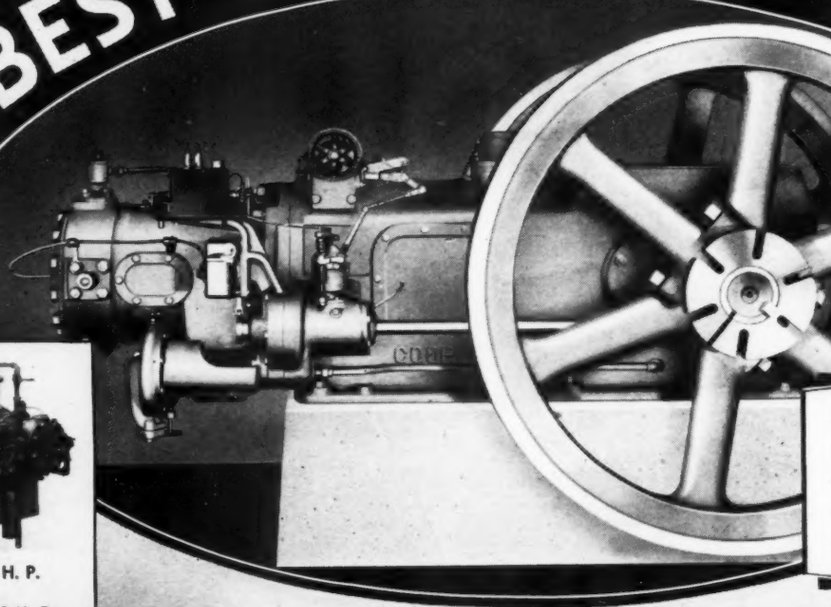
Early Bessemer type pumping engine built in sizes from 5 to 35 H. P. for Pennsylvania, Ohio and West Virginia oil fields.

ORIGINALLY a builder of steam engines, Cooper-Bessemer began designing gas engines to eliminate the steam boiler and save fuel. The line now includes low speed horizontal gas engines, both two and four-cycle types; direct gas engine driven compressors, both low and high speed vertical multi-cylinder gas and Diesel engines and large double-acting gas engines. Sizes range from 15 to 1600 H. P. for practically every oil and gas industry requirement.

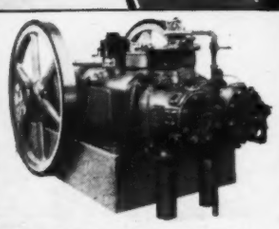
A growing outlet for oil-field products is furnished by the many Cooper-Bessemer Diesels that serve industrial plants and marine craft everywhere.

1833 1937

THE BEST IN THE 20th CENTURY



Modern Cooper-Bessemer type G-AO pumping engine, sold as 45 H. P. actually develops 64 H. P. at 200 revolutions and 98 H. P. at 300 revolutions.



Type G-AU, 60 to 110 H. P.

Type G-AW, 100 to 150 H. P.

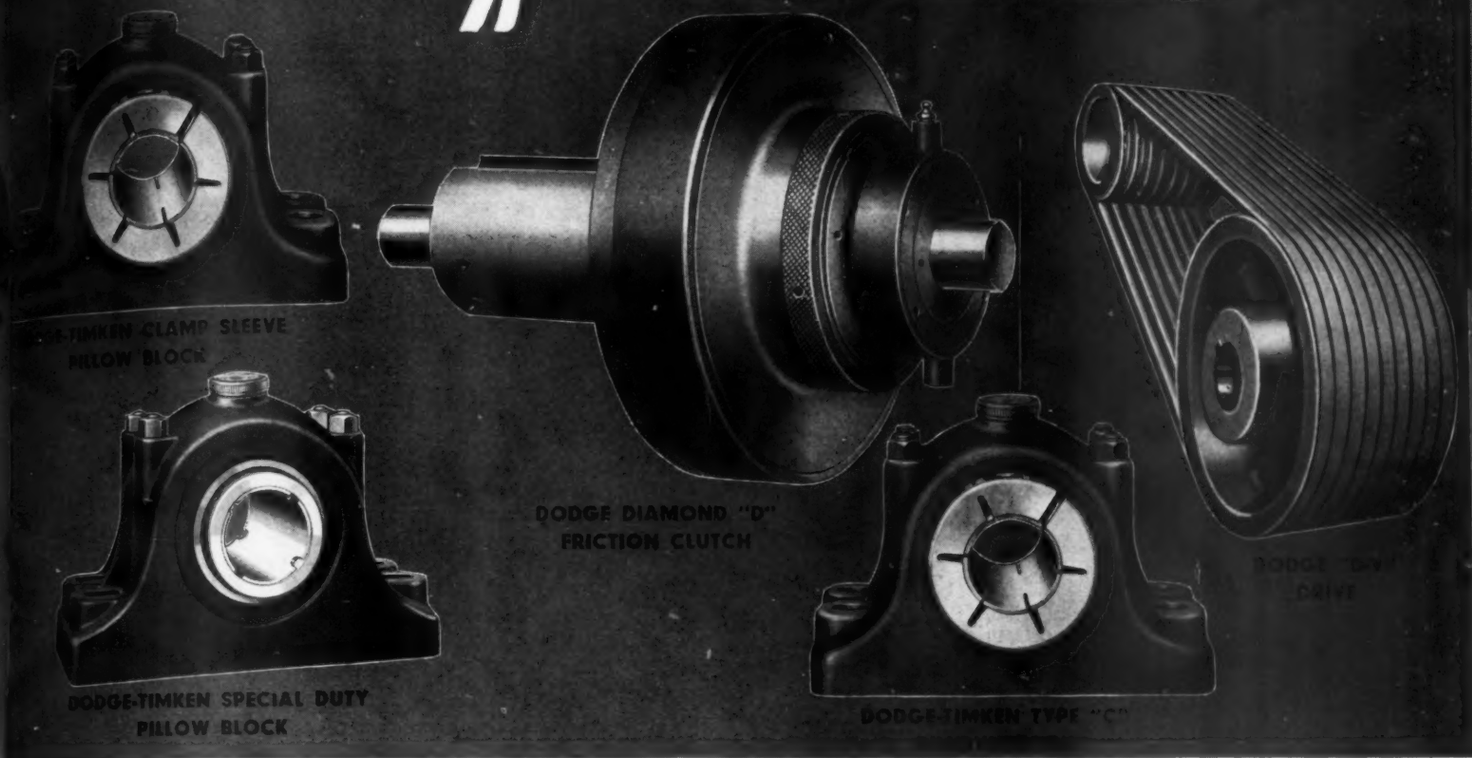
Used for driving water pumps, central pumping powers and electric generators.

THE COOPER-BESSEMER CORPORATION

Mount Vernon, Ohio — PLANTS — Grove City, Pennsylvania

25 West 43rd Street, New York City
Mills Building, Washington, D. C.
640 East 61st Street, Los Angeles, Calif.
201 East 1st Street, Tulsa, Oklahoma
631 Spring Street, Shreveport, La.
Magnolia Building, Dallas, Texas
Esperson Bldg., Houston

Backed by Performance


DODGE-TIMKEN CLAMP SLEEVE PILLOW BLOCK
DODGE DIAMOND "D" FRICTION CLUTCH
DODGE-TIMKEN SPECIAL DUTY PILLOW BLOCK
DODGE-TIMKEN TYPE "C"

• In the oil fields—where power transmission equipment must stand up to severe continuous service — there you will find Dodge power drive units, noted for their ruggedness and performing dependably.

• The Dodge line includes everything for the mechanical transmission of power in the oil industry. Each product is built to uniform standards of quality of material and workmanship. Dodge engineering service is available for the design of special power drive units to meet individual requirements. The complete line of standard products available means that Dodge engineers can select the right type of every appliance for the specific job.

• Dodge power drive and bearing units have built up an enviable record of performance in the oil fields. Dodge engineers are familiar with your production problems. Dodge units, therefore, combine correct engineering with quality manufacturing which insures economical and dependable service.

DODGE MANUFACTURING CORPORATION
MISHAWAKA, INDIANA
U. S. A.

•

Write for complete catalogue. See our oil field transmission section in the Composite Catalogue.

THE Right DRIVE FOR EVERY JOB

There is added VALUE in the Name DODGE

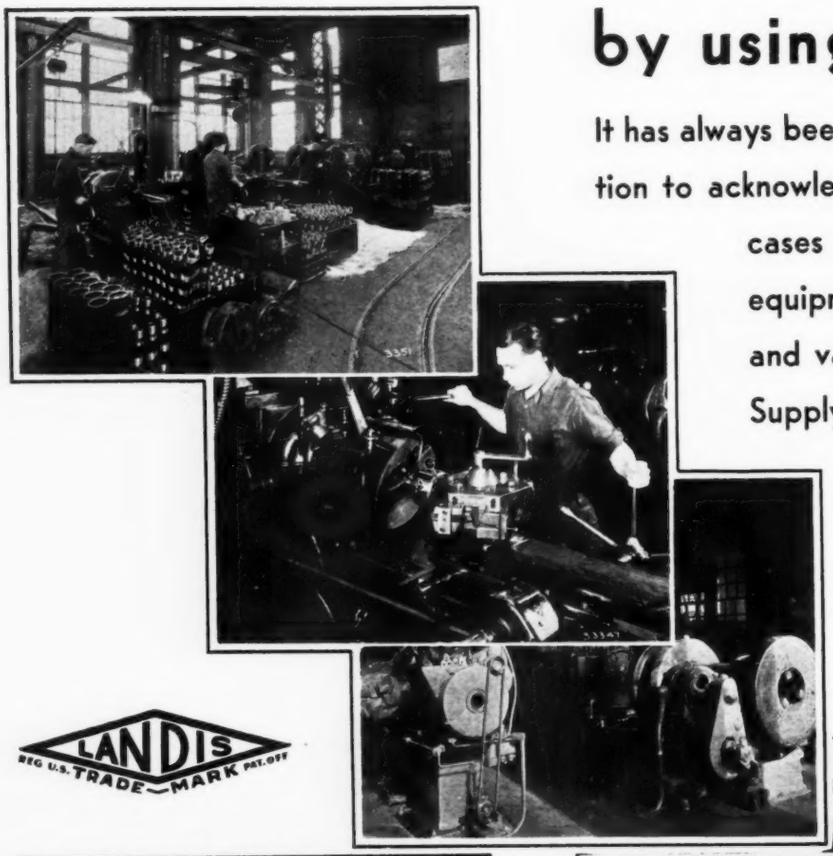
DODGE
MISHAWAKA

From Coast to Coast

OIL WELL SUPPLY CO.

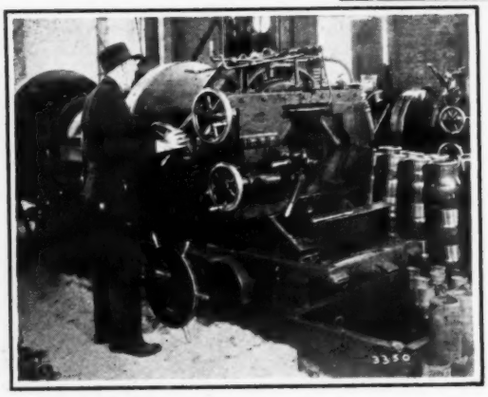
maintains *Thread* quality

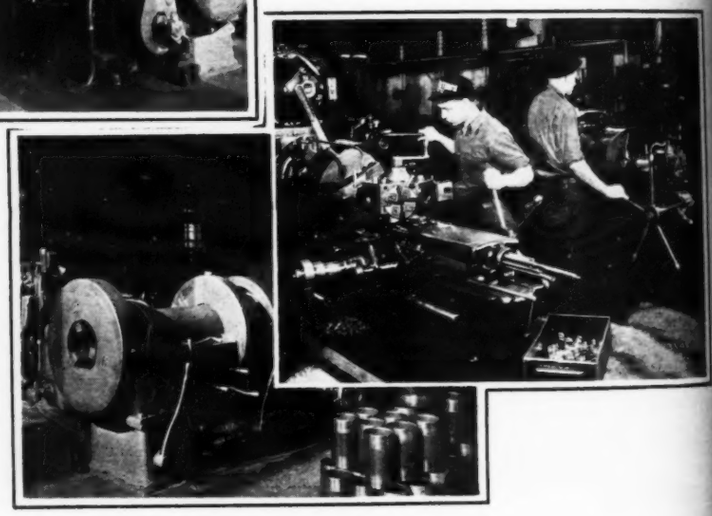
by using LANDIS



It has always been a source of profound satisfaction to acknowledge the general—and in many cases exclusive—usage of LANDIS equipment in the manufacturing plants and various branches of the Oil Well Supply Co. Such acceptance is gained only by building a quality product, by giving honest service and by fair dealing.

LANDIS
REG U.S. TRADE—MARK PAT. OFF





LANDIS MACHINE COMPANY, INC.

WAYNESBORO, PENNA., U. S. A.

To Best Meet Today's Needs

Salutation!

THE GREAT SERVICE RENDERED TO THE INDUSTRY BY THE OIL WELL SUPPLY COMPANY HAS LONG BEEN A RECOGNIZED FACT, AND WE WISH TO OFFER FELICITATIONS ON THE INAUGURAL OF THEIR SEVENTY-FIFTH ANNIVERSARY.

THE FRIENDLY RELATIONSHIP BETWEEN THE OIL WELL SUPPLY COMPANY AND THE HUGHES TOOL COMPANY BEGAN MORE THAN A QUARTER OF A CENTURY AGO AND HAS CONTINUED THROUGHOUT THE YEARS. WE COMMEND THIS INSTITUTION OF SERVICE TO THE ENTIRE INDUSTRY.

HUGHES
ROCK BITS

Hughes "Tailor-Made" Rock Bits meet a Modern Need with a Modern Product...

Realizing no single Rock Bit design can possibly meet today's exacting demands of the Industry, Hughes Tool Company has developed and proven specific designs, "Tailor-Made," for recognized formations, drilling weights and rotary speeds.

From Broken Formations to Pyrite—there's a "Tailor-Made" Hughes Rock Bit especially designed for your drilling problems.

Proven results are: more footage per bit—faster time, straighter hole and a saving of expensive round trips.

WORLD'S DEPTH RECORD
CORE RECOVERY AT 12,786 FEET

"Readable" Cores

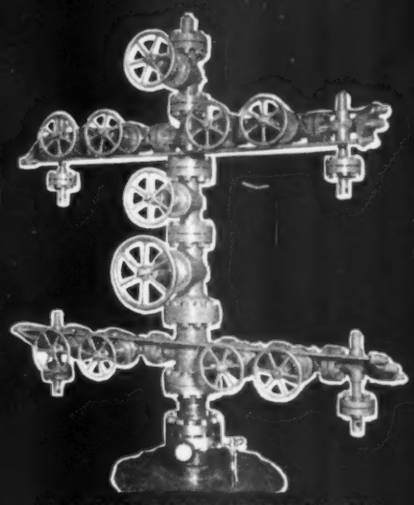
HUGHES
CORE BITS
GIVE YOU WHAT YOU WANT

Hughes Core Bits have been designed and built to thoroughly do the job for which they are intended: to bring to the derrick floor cores of a quality and quantity necessary for correct engineering study.

New and improved features of Hughes Core Bits provide greater economy in operation . . . larger diameter cores . . . floating core barrel . . . double core catcher . . . interchangeability of hard and soft formation heads . . . core barrel vent to relieve pressure above core . . . plug for keeping barrel clean when going in hole . . . ease of dressing and handling.

Simplicity, long life and proven performance of Hughes Core Bits offer you the assurance of "Cores When You Need Them."

Protection to your Well Investment



A HUGHES CHRISTMAS TREE ON TEST
Careful inspection and complete tests on all Hughes Valves and Fittings provide maximum protection to your well investment.

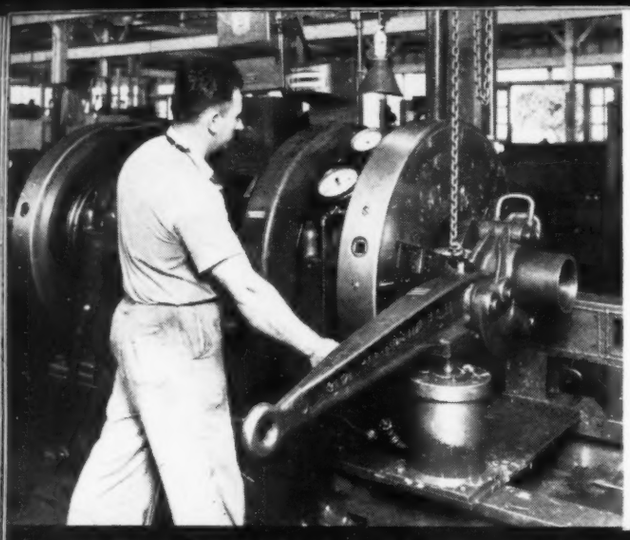
HUGHES
VALVES & FITTINGS

Hughes Heat-Treated Cast Chrome Nickel Steel Valves and Fittings offer maximum protection, especially on high pressure wells or where unusual conditions may be encountered.

The Gate in Hughes Valves is of the solid wedge type accurately guided by ribs in the valve body. Seating surfaces are as finely finished as the cylinders in your car. Lubrication features incorporated in Hughes Valves further insure a gas or fluid tight seal, greater ease of operation and longer life.

Design, material, workmanship and complete tests combine in giving to Hughes Valves and Fittings the position of leadership in the Industry.

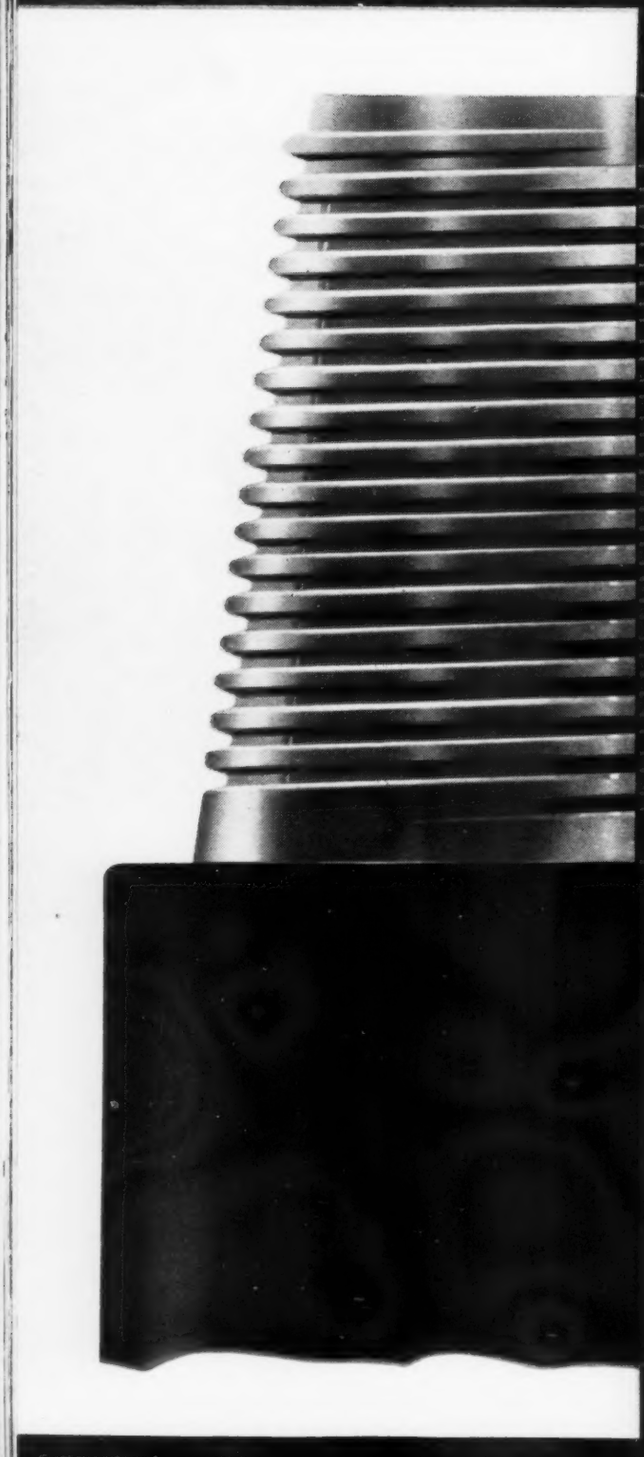
You can depend on Hughes Valves and Fittings.



Bucking Hughes Tool Joints on drill pipe under controlled torque,—a contribution by Hughes Tool Co. to the Industry.

FOR THE REALLY *Tough Jobs*

HUGHES TOOL JOINTS



Important Steps in the manufacture of Hughes Tool Joints include:

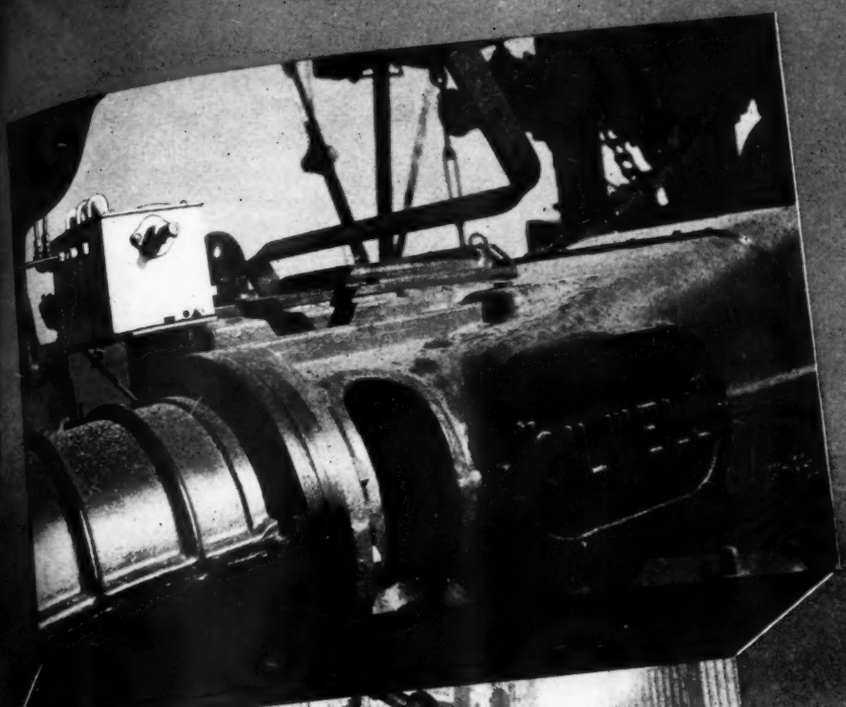
—*Selection of highest quality Alloy Steel.*

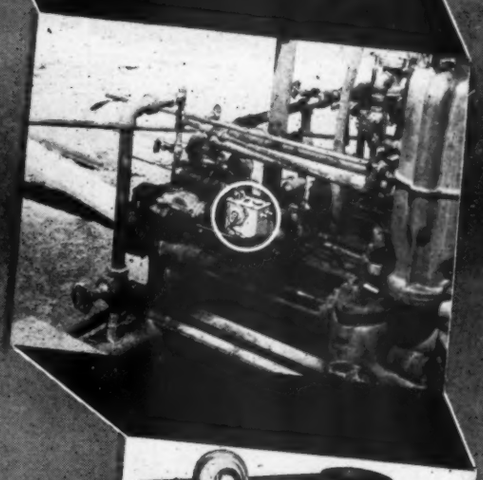
—*Proper Heat-Treatment which renders the steel strong, tough and wear-resisting.*

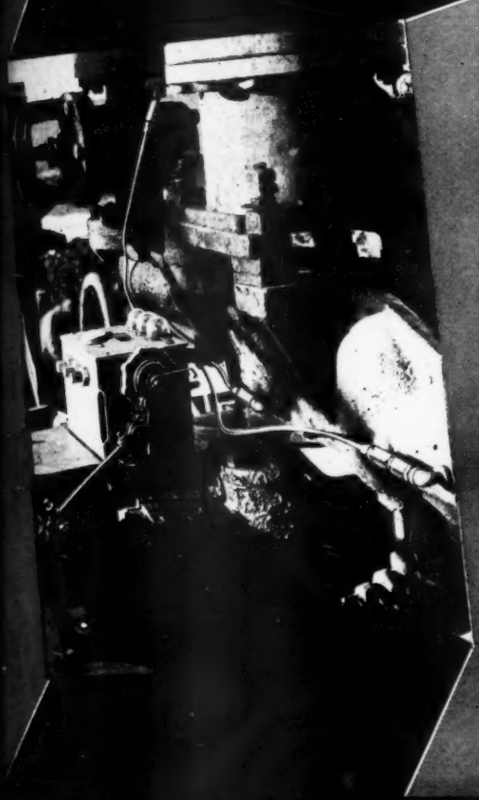
—*Final rigid inspections and tests. (Every Hughes Tool Joint receives 35 individual inspections and tests before being put into field service.)*

Each of these steps has been worked out by years of manufacturing experience and costly research—All this and more you get in every Hughes Tool Joint, but Hughes Service goes further—Bucking of Tool Joints on pipe, under controlled torque, was pioneered and developed by Hughes Tool Company—Proper welding of joint to pipe after Bucking-Up offers the best drill stem insurance against twist-off. Hughes facilities and equipment for Bucking-Up and Welding-On provide the highest type of service to the Industry.

HUGHES TOOL COMPANY
HOUSTON, TEXAS · U.S.A.





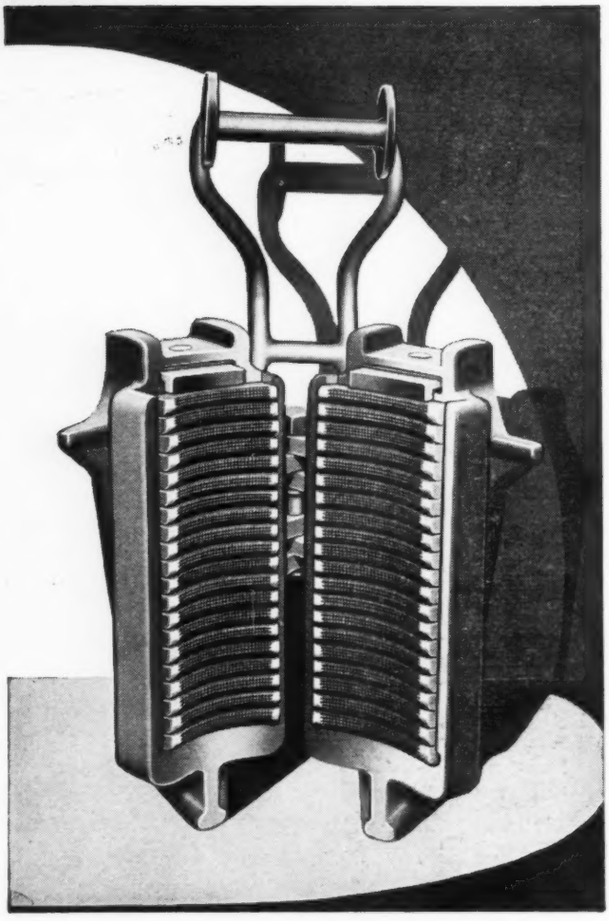


"STANDARD" Lubricators have proven that dependable lubrication in the oil fields is not expensive . . . that repairs on valuable machinery due to conventional oiling methods is no longer necessary. Operators know from experience they can shift their lubrication problems to "STANDARDS." Month after month the popularity of these better lubricators keeps growing, and today you'll see them protecting the better class of equipment wherever you go in the field. Get full details from your 1937 Composite Catalog, from your Supply Store, or direct from American Lubricator Company, Dallas, Texas. For export, address Oil Well Supply Company.

"STANDARDS"

FOR DEPENDABLE OIL COUNTRY LUBRICATION

EXPERIENCE Plus



New MISSION ROTARY SLIPS

Save money by saving pipe and speeding up round trips

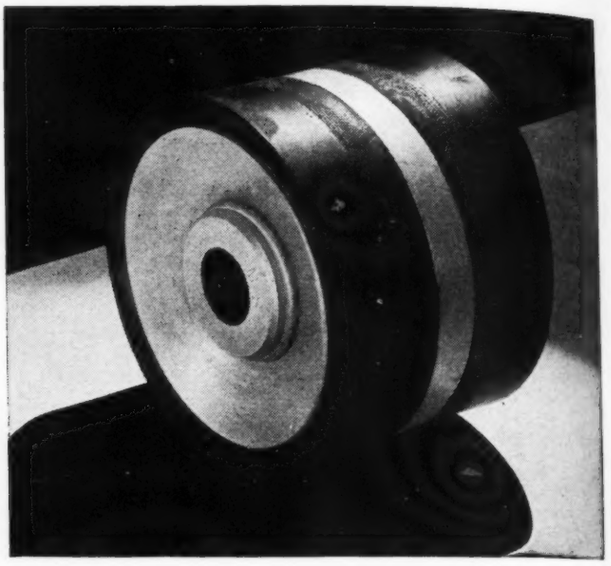
THE UNIQUE PRINCIPLE OF ROLLING DOGS gives a gradual, cushioning grip. Positively will not cut, mar or bottleneck the pipe. Insurance against many long drawn out, hazardous, and costly fishing jobs due to damaged pipe.

POSITIVELY ELIMINATES THE GREATEST CAUSE OF DELAY IN HANDLING PIPE, namely sticking in bowl. The dogs roll away from the pipe as it is pulled assuring instant release. Fast handling of pipe saves money.

QUICK INSTALLATION ON THE DERRICK FLOOR of new dogs and other worn parts, puts old slips on a par with new slips, in efficient, economical performance.

EASIER AND FASTER TO HANDLE. Saves crews and costly accidents.

Improved MISSION SLUSH PUMP PISTONS



CUT UPKEEP COSTS IN HALF

Replaceable rubbers on a long-lasting body. Replaceable on the derrick floor without removing piston from rod.

DROP-FORGED, CHROME NICKEL STEEL . . . ONE PIECE CONSTRUCTION
. . . resists any pressure.

DESIGNED TO FIT A TAPERED ROD
. . . preventing cutouts around piston and rod, saving rod and piston costs.

GREATLY INCREASED WIPING SURFACE PREVENTS BY-PASSING
. . . thereby lengthening the life of piston and liners.

MAKING ECONOMY RECORDS IN EVERY OIL COUNTRY THE WORLD OVER.

●

MISSION SLIPS ARE USED PRACTICALLY 100% ON ALL WELLS DRILLED BELOW 8,000 FEET IN THE MID-CONTINENT AND GULF COAST FIELDS . . . . BY FAR THE LARGEST SELLING SLIP THROUGHOUT THE WORLD.

MISSION MANUFACTURING CO.

HUMBLE ROAD » » » » » » HOUSTON, TEXAS

MISSION SLIPS . . . MISSION VALVES . . . MISSION PISTONS . . . MISSION PISTON RODS . . . MISSION SWABS

PROGRESSIVENESS

THE three quarters of a century of experience of the Oil Well Supply Company spans the history of the American oil industry—from three years after the 69½ foot Drake discovery well to modern 2-mile-deep wells.

This is a rich progressive experience, indeed, to back up recommendations as to the proper tools for modern drilling.

NEW MISSION VALVELESS SWABS

TANDEM MODEL

SWABBING 3 TO 15 TIMES FASTER

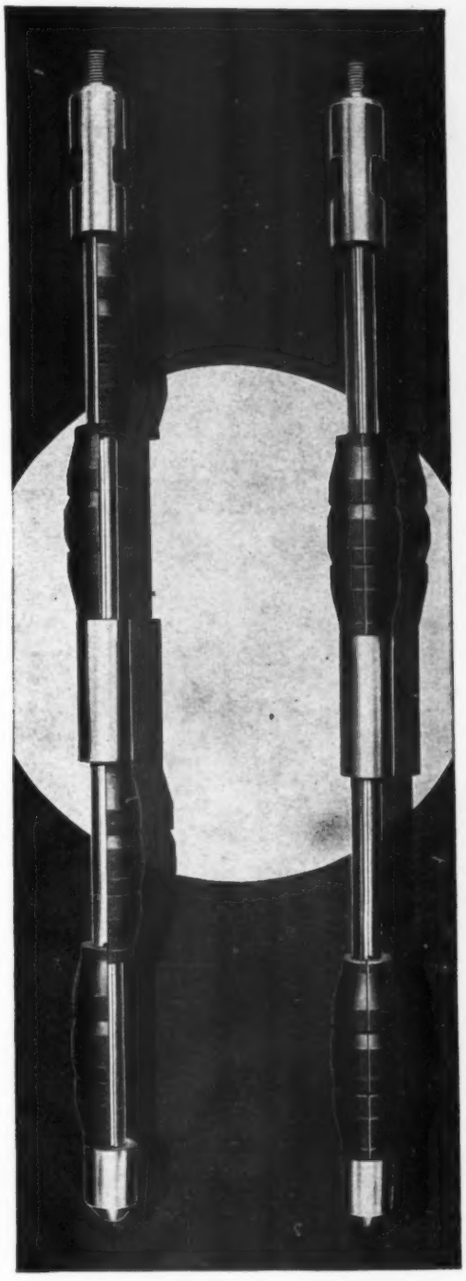
. . . protecting the sand . . . profits from oil gotten into the tanks quicker WOULD INTEREST YOU, WOULDN'T IT?

THE MISSION VALVELESS SWAB **FALLS LIKE A PLUMMET** due to the **SPLIT-RUBBER PRINCIPLE.**

Half the rubber rises above and clear of the stationary half, allowing direct and unrestricted fluid passage.

SAFER: Gas pressure will open split rubber, permitting gas to by-pass, resuming its load without loss after gas has passed. No loose line over derrick floor to endanger crew.

NUMEROUS RECORDS INVARIABLY SHOW 3 TO 15 TIMES FASTER SWABBING WITH MISSION VALVELESS SWABS



DOWN STROKE

Note that half of each rubber has raised above stationary half . . allowing an area for fluid passage larger than the area of flow around the A. P. I. pin.

UP STROKE

Note that movable half of each rubber has dropped back beside its other half. Rubbers now in swabbing position.

MISSION MANUFACTURING CO.

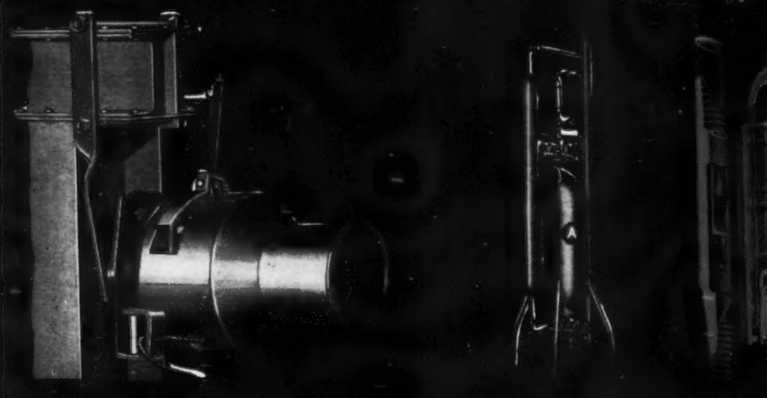
HUMBLE ROAD » » » » » » HOUSTON, TEXAS

MISSION SLIPS . . . MISSION VALVES . . . MISSION PISTONS . . . MISSION PISTON RODS . . . MISSION SWABS

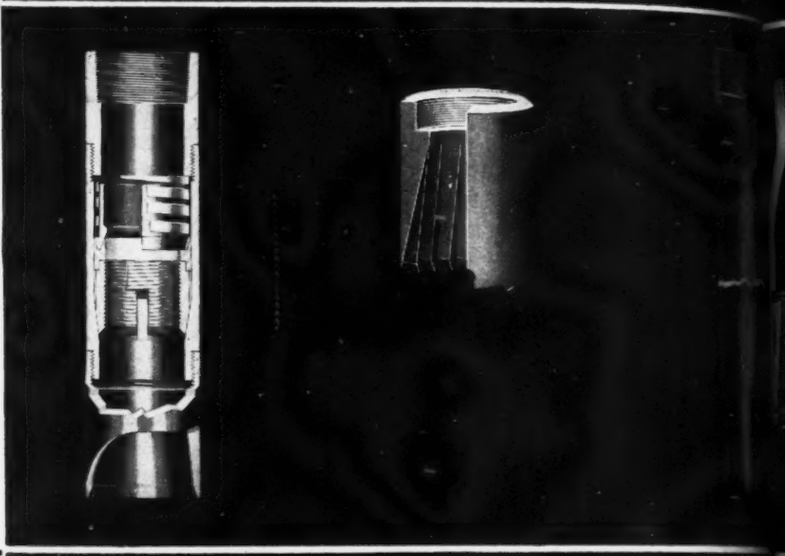
AMERICAN PRODUCTS F

CONGRATULATIONS "OILWE N

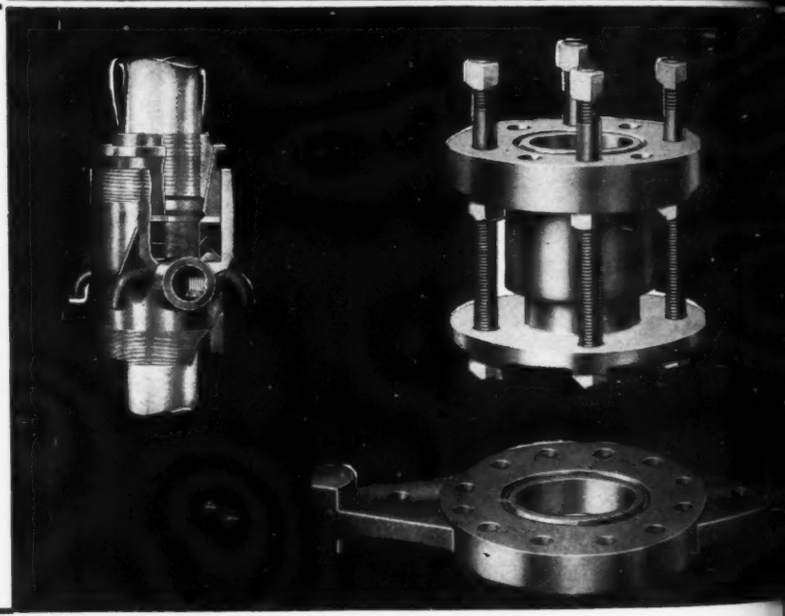
YOU NEED THESE "AMERICAN" PRODUCTS FOR MODERN DRILLING . . .



THESE EFFICIENT "FELLOWS" ARE CLEANING-UP DIFFICULT FISHING JOBS EVERY DAY



FOR CONTROLLING WELLS..THESE DEPENDABLE PRODUCTS CAN'T BE BEAT!



OKLAHOMA CITY, OKLAHOMA
SEMINOLE, OKLAHOMA
FITTSTOWN, OKLAHOMA
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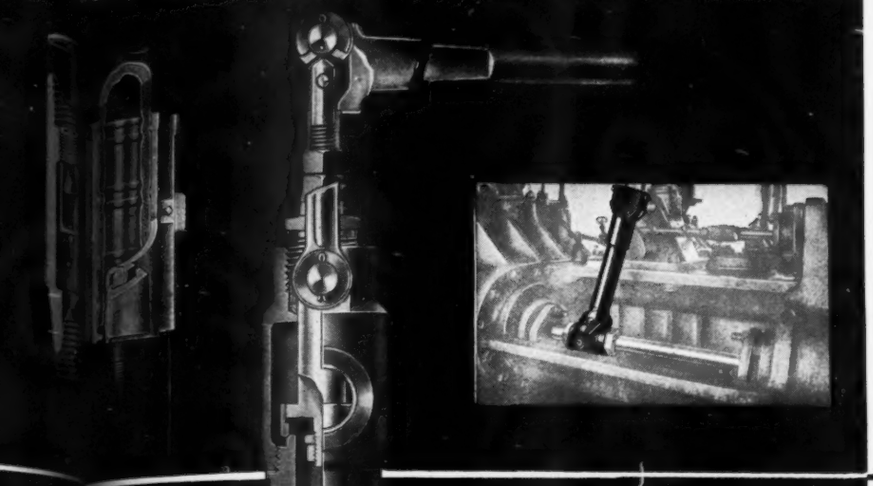
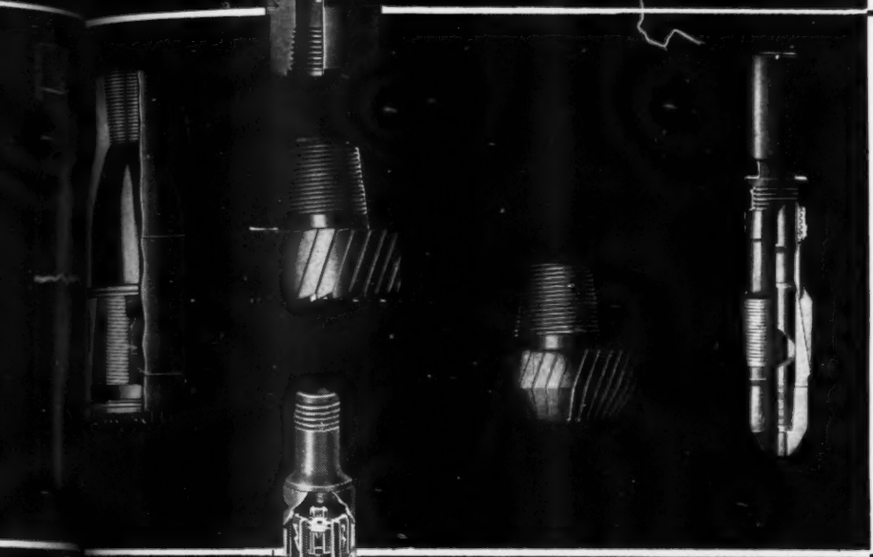
AMER
IRON & MACHIN

CTS For Perfect Performance

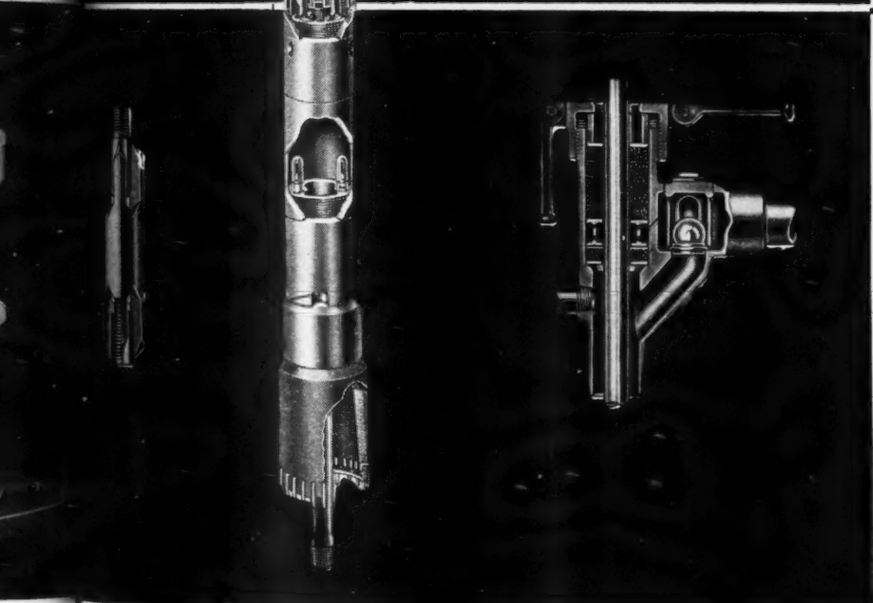
LWE N YOUR 75th ANNIVERSARY



- Automatic Cathead . . . Because of its greater speed in operation, safety to crew, protection of machinery, and durability, this cathead has won universal acceptance. Has 4-point engagement and 2-point disengagement. Only nine parts, with five of them working parts.
- Steam Lubricator . . . Has two high pressure bullseye sight feeds separately controlled to allow one to be removed for repairs and cleaning without interfering with operation of the other. 12-gallon capacity, built to withstand 350 lbs. working pressure.
- Drill Pipe Float Valve . . . Made in regular or full hole sizes and designed to give maximum safety in any depth of hole.
- Boltless Hose Coupling . . . Designed for use with high pressure rotary hose installation, used with improved deep drilling equipment. The nozzle is made of special heat treated alloy steel to withstand high velocity pressure of sand laden drilling fluid.
- Release Valve . . . Consistent and increased sales of this valve prove that it's outstanding and dependable. It is simple in construction, fool-proof and rugged. Provides perfect performance at lowest cost.
- Rocker Arm . . . Helps run more smoothly and efficiently, eliminates knocking and needless noise, and makes valves easier to adjust. Practically all working parts are fully enclosed to keep out all foreign substances. Easily installed.



- Releasing and Circulating Overshot . . . An all purpose fishing tool used successfully for fishing out any object that can be grasped with a slip type socket. American also can furnish Double Bowl Overshots, or convert your overshot into a double bowl type; thus providing an overshot ready at all times to catch drill pipe or tool joint.
- Wall Hook and Milling Shoes . . . are interchangeable with standard guide on overshot.
- Although American Cone Fishing Socket . . . was originally designed to catch loose cones, it is also successful for fishing other small objects from the hole. It will mill through shale and boulders to recover buried fish.
- Type K and L Milling Shoes . . . are designed so teeth are kept clear of cuttings, thus eliminating all unnecessary friction and wear on the mills. Made of special alloy steel which can be successfully dressed and tempered in any oil field repair shop.
- Releasing and Circulating Spear . . . Used successfully the world over for fishing for liners, casing, drill pipe and tubing. Its rugged construction, simple design and quick, positive releasing features, all combine to provide a dependable performance which saves both time and money.



- Type "A" Casing Suspender and Blowout Preventer . . . Designed for extreme heavy duty. Tested to 5000 pounds with a safety factor far in excess of any pressure or depth of well that has so far been drilled. Specially designed fire-proof packing.
- Safety Packing Flange . . . especially designed to pack off underneath gate valve that is screwed on oil string, eliminating leakage in case of cutting out around gate valve connection.
- Tie Down Companion Flange . . . is designed to take the place of the old style casing clamps and to eliminate the use of pipe nipples between gate valves in hook-ups on high pressure wells, providing a correct means for tying the hook-up or Christmas Tree together.
- Sucker Rod Coupling and Paraffin Scraper . . . A versatile, three-in-one tool used successfully as sucker rod guide, paraffin scraper and load equalizer. Made of one-piece heat-treated steel to resist hardest usage.
- Flow Packer . . . A flowing device that will flow the average well that would otherwise have to be pumped.
- Pumping Well Christmas Tree . . . A simplified modern method of connecting up a pumping well to the lead line. It contains all necessary parts in one compact steel body, such as check valve, self-lubricating stuffing box, and bleeder outlet. Only two connections are necessary, thereby eliminating leak hazards common in the usual type of hook-ups.

RCAN

IN WORKS COMPANY

CALIFORNIA REPRESENTATIVE

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EXPORT OFFICE

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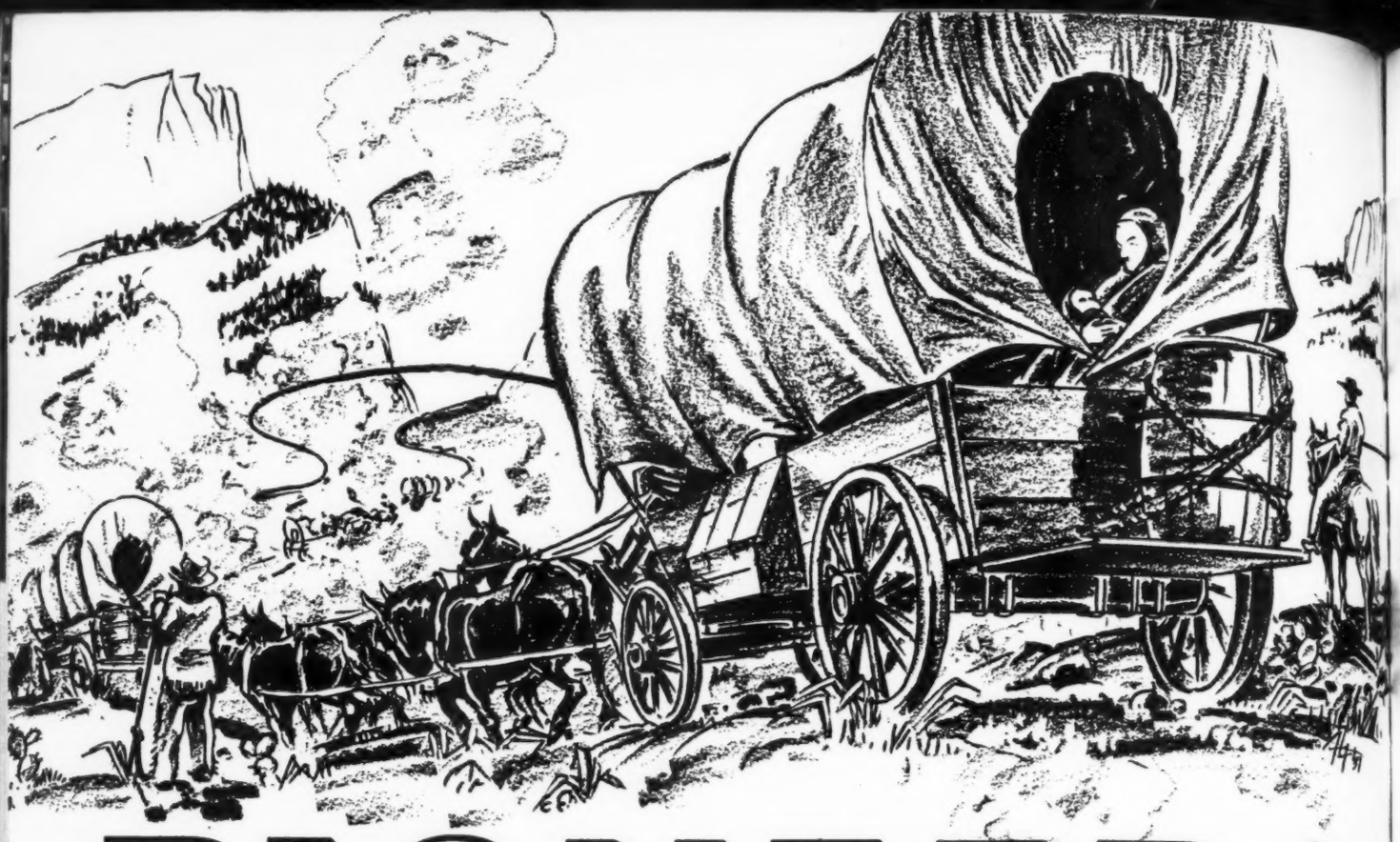

PIONEERS

CONGRATULATIONS to our exclusive Export Distributor, the

OIL WELL SUPPLY COMPANY

which, as a pioneer, founded the service that has for 75 years been carried on as an indispensable part of the oil industry throughout the world. Through the vast facilities of this organization, Shaffer High Pressure Control Equipment, fishing tools and other products are available to oil operators in every foreign field.

SHAFFER TOOL WORKS

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SHAFFER

Specialists in

HIGH PRESSURE DRILLING AND CONTROL EQUIPMENT

FISHING TOOLS THAT EXCEL

Described in detail on Pages 1548 to 1576 of the 1937 COMPOSITE CATALOG

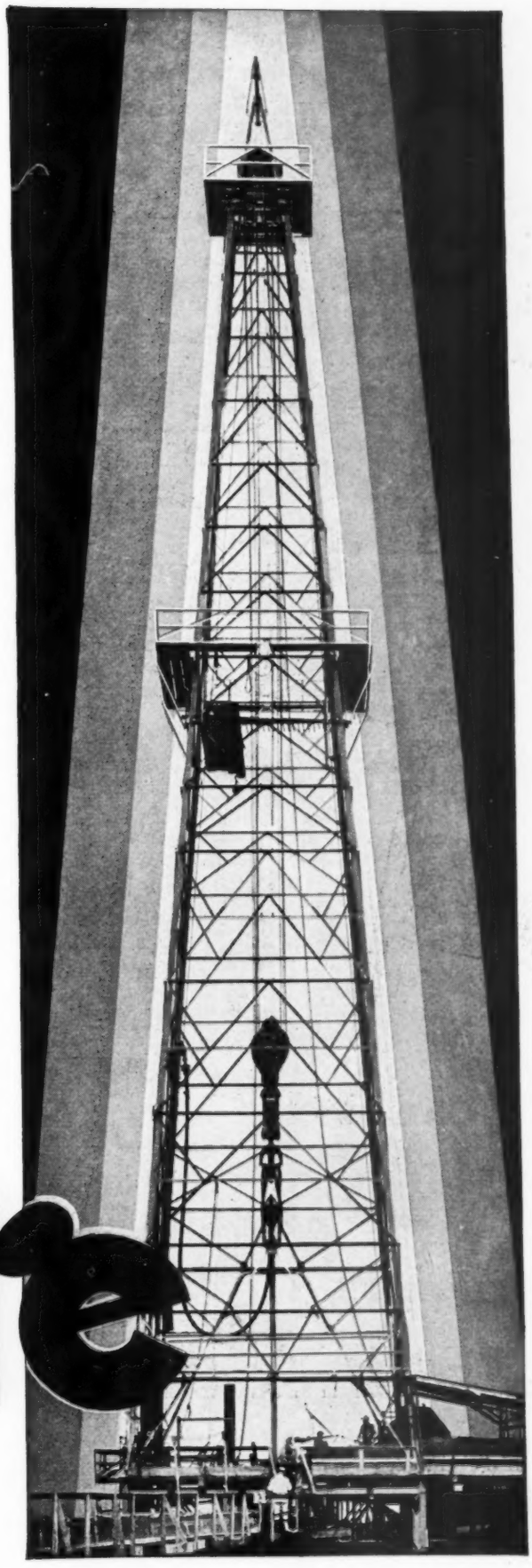
Congratulations

to

Oil Well Supply Company

on 75 Years of Service

to the Oil Industry



DERRICKS

PUMPING EQUIPMENT

Moore

LEE C. MOORE & CO., INC.

TULSA

PITTSBURGH

KEROTEST

VALVES FITTINGS

"OILWELL"

DOING THE JOB

There's a reason why Kerotest Valves and Fittings enjoy the confidence of leading drillers throughout the petroleum world . . . there's a reason why Kerotests are used on the world's deepest wells . . . why they are specified for the most severe service and high pressure operations. The reason is an UNBROKEN RECORD OF PERFECT PERFORMANCE . . . the KNOWLEDGE THAT KEROTEST HAS BUILT QUALITY INTO EVERY PART . . . the assurance of TIME PROVED EXPERIENCE that SAFETY AND DEPENDABILITY are inherent in every Kerotest Product.

KEROTEST

VALVES FITTINGS

"OILWELL"

JOB THE WORLD OVER

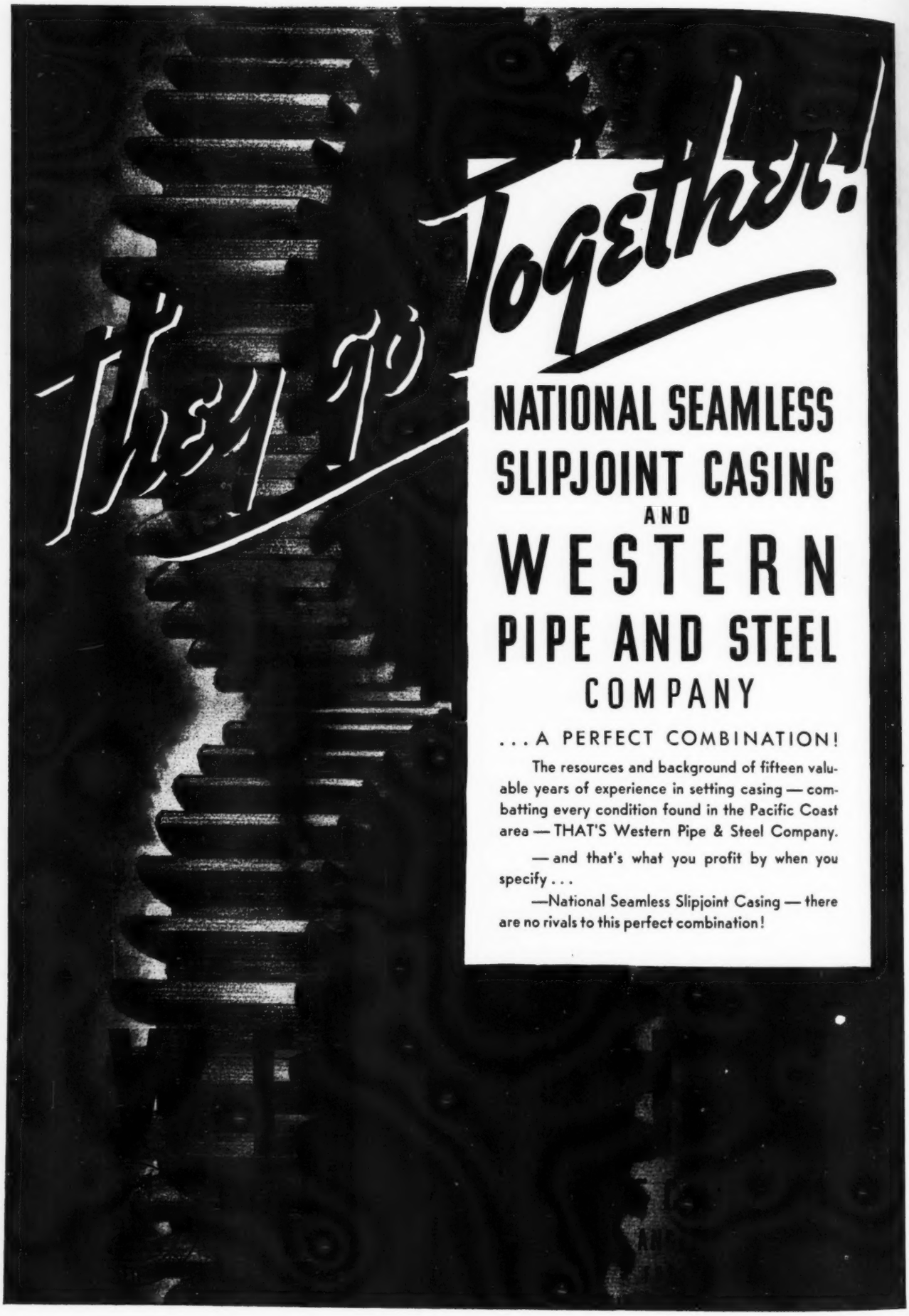
Kerotest type "O" Standard Test Valve. Service Design 6000 lbs. Test Valve.

KEROTEST MANUFACTURING COMPANY

PITTSBURGH, PA.

Export Distributors—OIL WELL SUPPLY COMPANY—Dallas New York Tampico London

Manufacturers of Cast Steel Drilling Valves . . . Flow Line Valves . . . Fittings for Oil Field Service . . . Forged Steel Fittings for Every Service . . . Master Controls and Tubing Hangers . . . Forged Steel and Cast Steel Control Chokes . . . Forged Steel Flange Unions . . . High Pressure Oil Savers, or Cable Tool Blowout Preventers . . . Cast Steel Balanced Throttle Valves . . . Forged Steel Gauge Shut-off Valves . . . Christmas Tree Hook-Ups . . . Refinery and Power Plant Valves . . . Universal Joints for Drilling and Flow Line Valves . . . Armco Ingot Iron Gaskets . . . By-Pass Assemblies for Drilling Valves.


They Go Together!
NATIONAL SEAMLESS
SLIPJOINT CASING
AND
WESTERN
PIPE AND STEEL
COMPANY
. . . A PERFECT COMBINATION!
The resources and background of fifteen valuable years of experience in setting casing — combatting every condition found in the Pacific Coast area — THAT'S Western Pipe & Steel Company.
— and that's what you profit by when you specify . . .
—National Seamless Slipjoint Casing — there are no rivals to this perfect combination!

WELDLESS JARS

...for greater strength!

Demand the strength, the uniformity, the trouble-freedom that WELDLESS drilling jars give you.

Spang's vast experience in cable-tools can be decidedly valuable to you. Ask Spang & Company (Butler, Pa.) for the answer to any cable-tool problem.

● *Spang "Higher-Standard" Cable Tools are carried in stock by "Oilwell" Stores, and by other distributors in all oil fields.*

Specify Spang

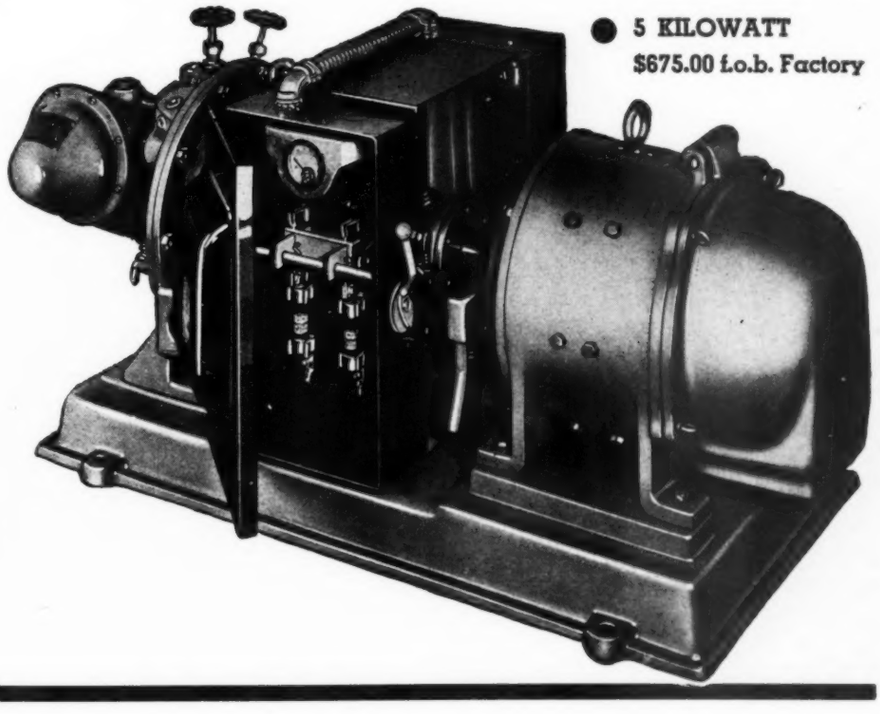
"HIGHER-STANDARD" CABLE TOOLS

RIG LIGHTING PLANTS

Announcing "Flolight" New

● 6 KILOWATT
$725.00 f.o.b. Factory

● 5 KILOWATT
$675.00 f.o.b. Factory

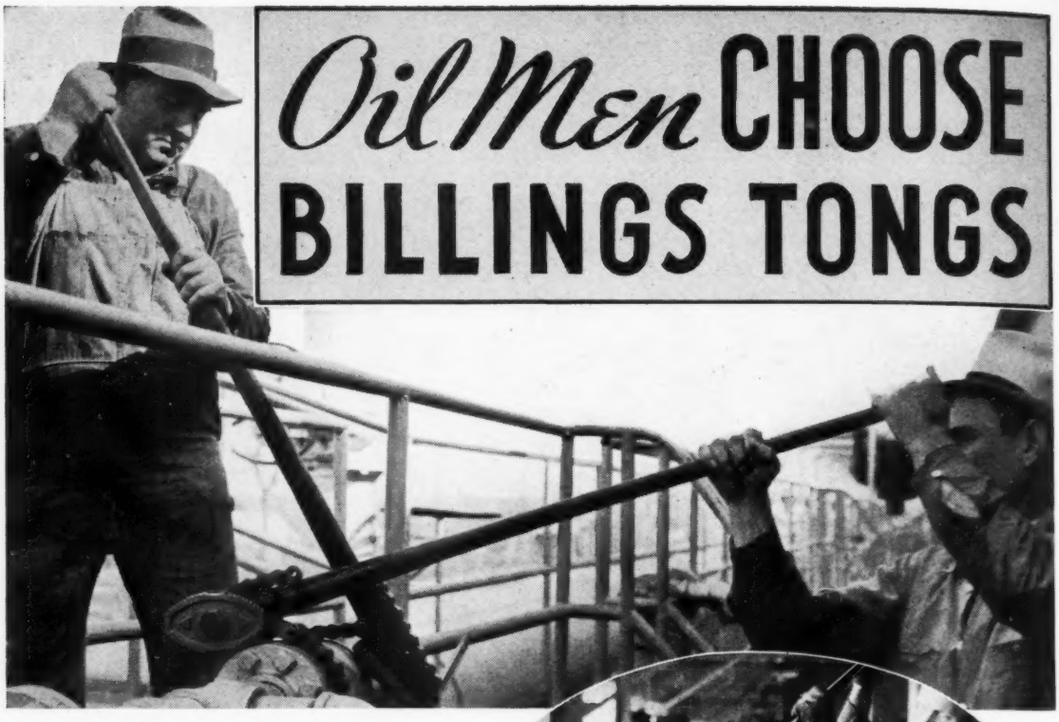


$100.00

ALLOWED FOR OLD GENERATOR, IN ANY CONDITION OR ANY MAKE, IN TRADE ON ABOVE SIZES EITHER DOMESTIC OR EXPORT

HUTCHISON
ENGINEERING WORKS
549 Washington Boulevard
CHICAGO

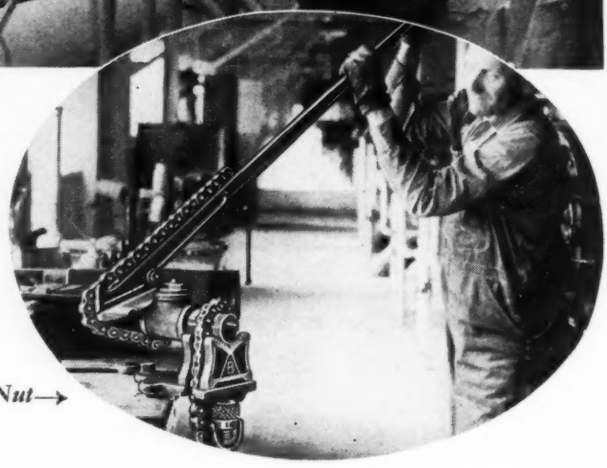
Oil Men CHOOSE BILLINGS TONGS



Billings "Red Head" Reversible Chain Pipe Wrench and a "Gardnerench" making up fittings on a pipe line.

the "GARDNERENCH"
is specially designed for fittings with narrow beads. Notice the workmen making up the pipe in a Billings Chain Pipe Vise.

Note: Elongated Knurled Nut—→



Billings "Red Head" Reversible Chain Pipe Wrenches are designed for rugged use on heavy work where speed and safety are necessary. You can turn a pipe in either direction without removing the Chain. Outer jaws are double-ended for double life. Remove these jaws and you have a real Fittings Wrench.

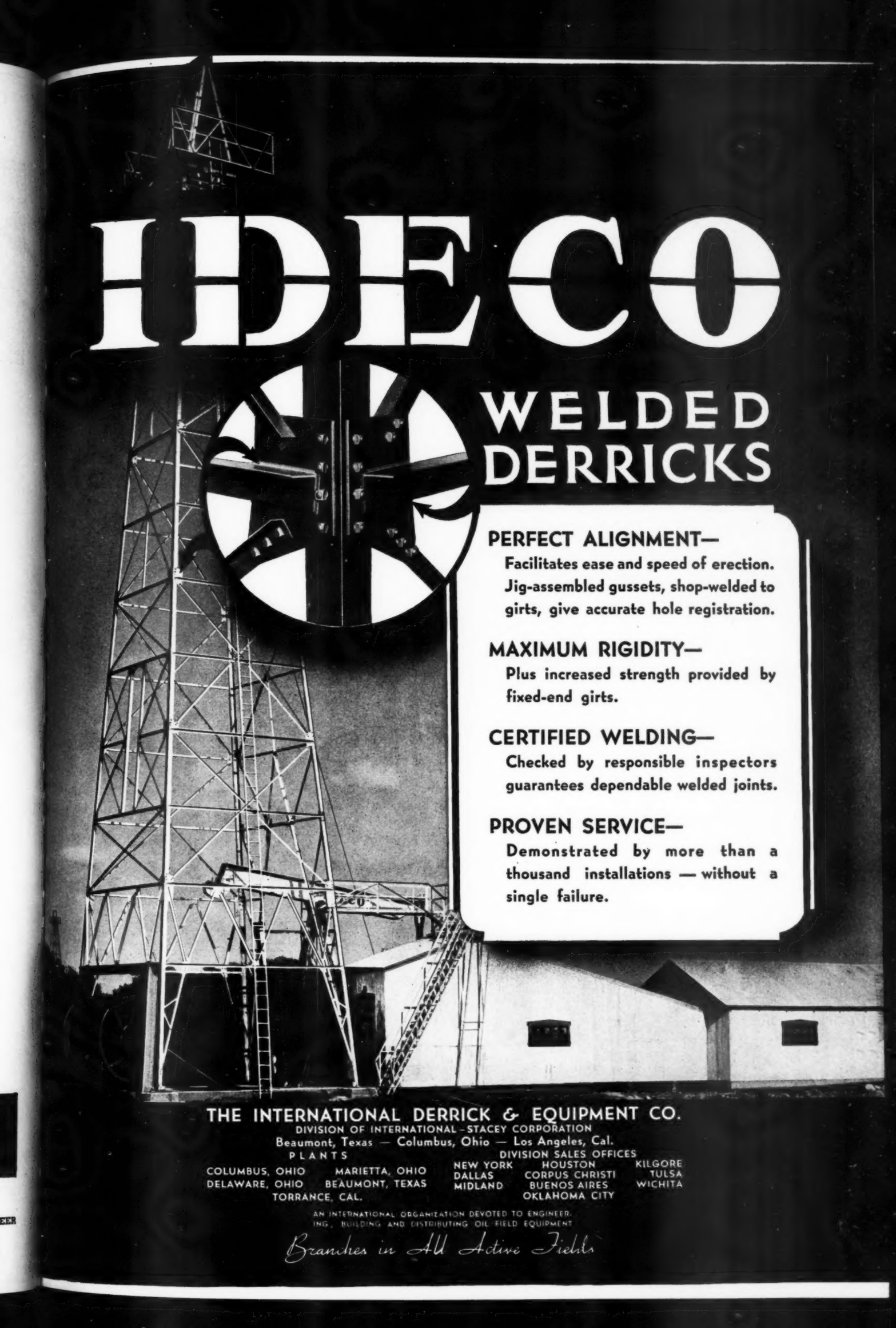
The "Gardnerench" is the only single-jaw, double-acting wrench that can be used for both pipe and fittings work. It is reversible without removing the chain. Jaw is replaceable. The "Gardnerench" is light in weight and perfect in balance with a minimum crushing effect on the pipe because the chain and pipe are in the same plane.

Congratulations to you, Oil Well Supply Company, on your seventy-five years of progress!

COMMERCIAL DROP FORGINGS · BOARD DROP HAMMERS and DIE MAKING MACHINERY

BILLINGS

THE BILLINGS & SPENCER CO. HARTFORD, CONNECTICUT, U. S. A.


IDECO
WELDED
DERRICKS
PERFECT ALIGNMENT—
Facilitates ease and speed of erection. Jig-assembled gussets, shop-welded to girts, give accurate hole registration.
MAXIMUM RIGIDITY—
Plus increased strength provided by fixed-end girts.
CERTIFIED WELDING—
Checked by responsible inspectors guarantees dependable welded joints.
PROVEN SERVICE—
Demonstrated by more than a thousand installations — without a single failure.
THE INTERNATIONAL DERRICK & EQUIPMENT CO.
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AN INTERNATIONAL ORGANIZATION DEVOTED TO ENGINEERING, BUILDING AND DISTRIBUTING OIL FIELD EQUIPMENT
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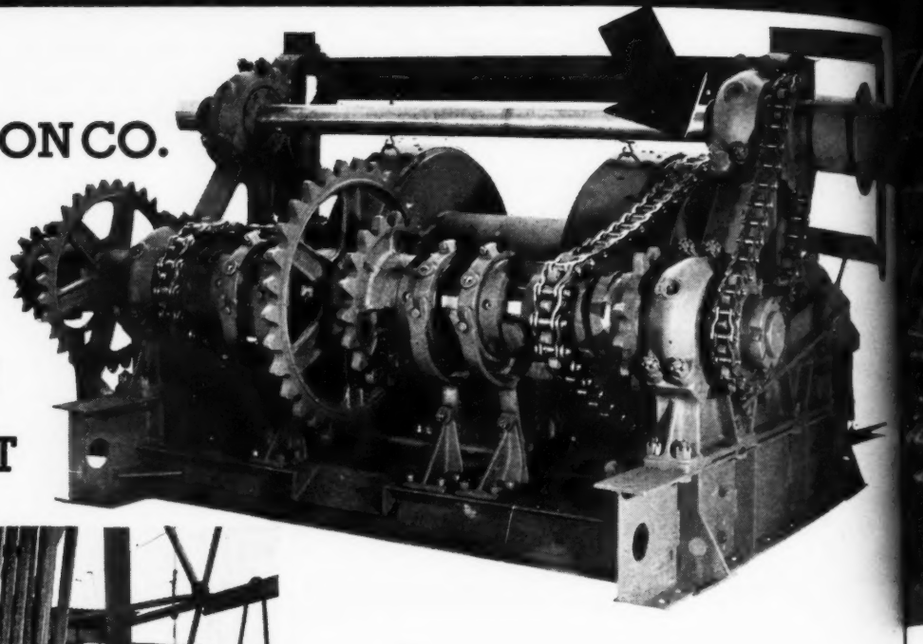
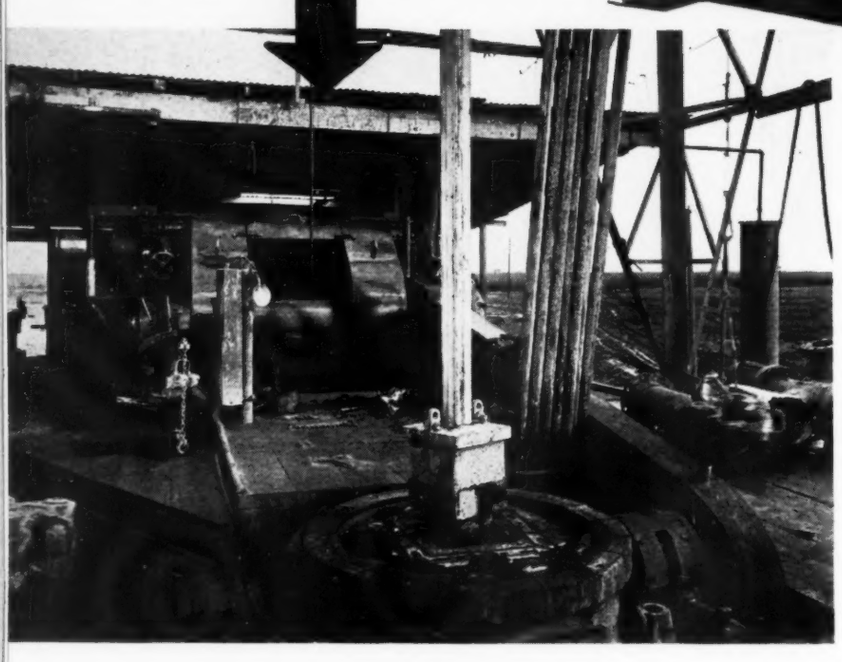
by
HAMMAN EXPLORATION CO.
at
BAY CITY, TEXAS
with
THE LAST WORD IN
DRILLING EQUIPMENT





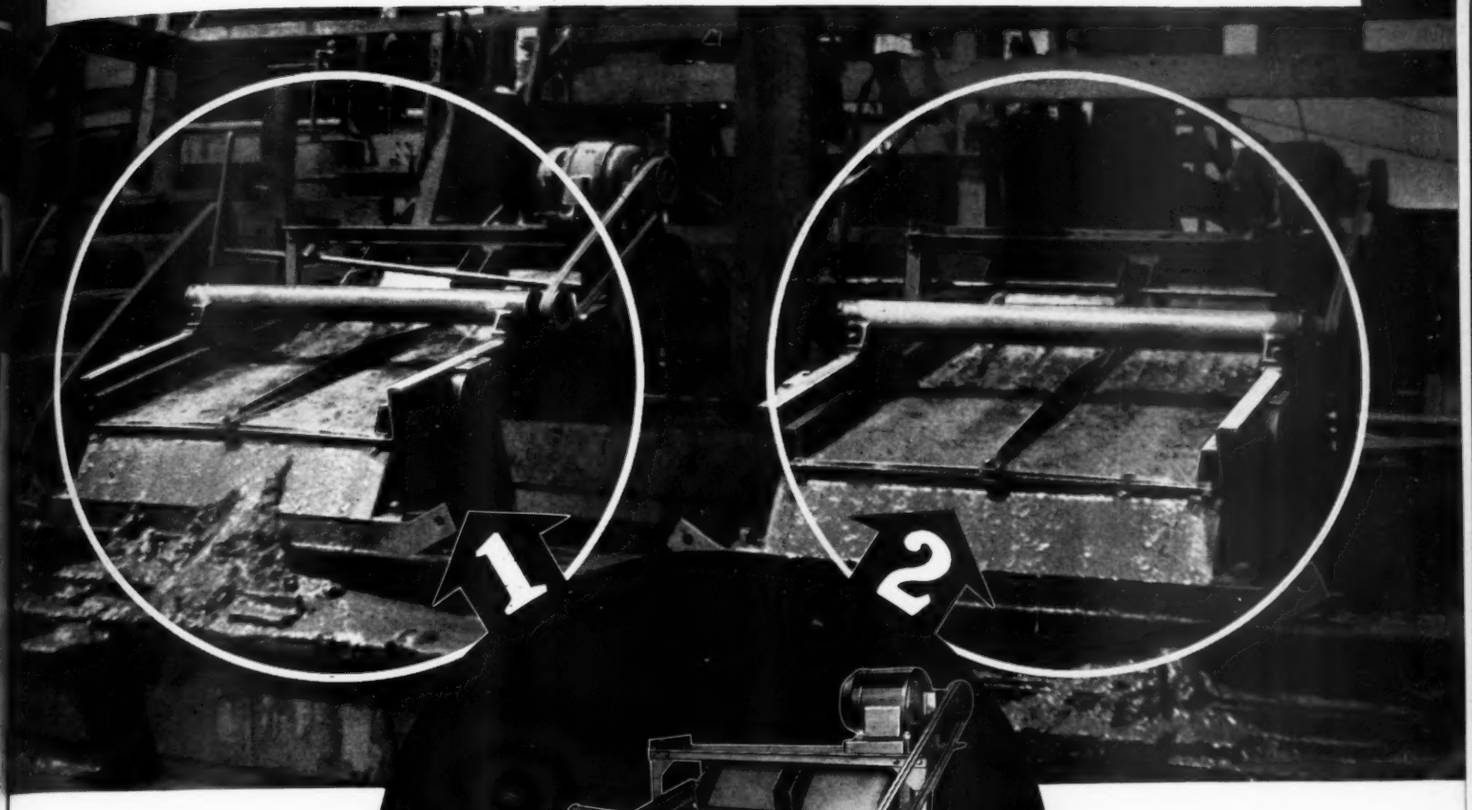
ANOTHER deep Gulf Coast field is under development . . . and another all Hyper Chain job rings the bell for smooth, dependable performance. It's Hamman Exploration Company's J. H. Crooker et al. No. 1, second hole at Bay City, Texas, which hit the pay at nearly two miles in 55 days' drilling time, despite cautious procedure to watch likely formations.

To the left is pictured the complete Oil-well rig with the new No. 7-P Hoist that drilled the job. This modern unitized hoist is equipped with all Hyper Chain (SS-124 3-bar Hyper and SS-40 Hyper) and with Link-Belt cut-tooth alloy-steel, heat-treated sprockets. Above is presented the Oil-well unit as photographed at the plant, before the chain guards were mounted.

Link-Belt Company, Philadelphia, Indianapolis, Chicago, Los Angeles, New York, Houston, Dallas, or Oklahoma City (W. H. Abele, Box 305, Route 4).

LINK-BELT CHAINS

Dual Control of An Abnormal Mud Problem



With this LINK-BELT Twin-Screen Hook-Up

Cron & Gracey find that LINK-BELT mud screens quickly pay for themselves

So abnormal was the circulating problem on this deep St. Martinville, La., drilling job of Cron & Gracey, contractors, that two LINK-BELT Vibrating Screens were installed as a double "shaker" hook-up.

First, the volume of fluid necessary for circulation required 15½ x 8½ x 20 inch slush pumps, using 8¼ inch liners. At 60 strokes per minute the slush volume was 580 gallons per minute. Average steam pressure maintained was 350 pounds, with the pumps working under about 1200 pounds pressure. Weight of the mud averaged 11.4 pounds, with a viscosity ranging from 26 to 34.

Several times during the course of drilling, circulation was lost due to unusually large cavities encountered, which resulted in the use of sawdust, sugar cane pulp and cotton seed hulls. During the time the mud system was saturated with these materials, the screens were "detoured," but they served very profitaby in cleaning up the mud and putting it back in condition after cavities were filled and normal drilling was resumed.

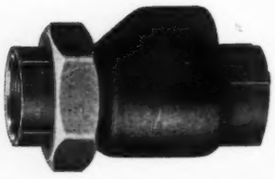
Send for Folder No. 1672. Address Link-Belt Company, Philadelphia, Chicago, Los Angeles, New York, Dallas, Houston, or Oklahoma City (W. H. Abele, Box 305, Route 4.) 5075

LINK-BELT SCREEN

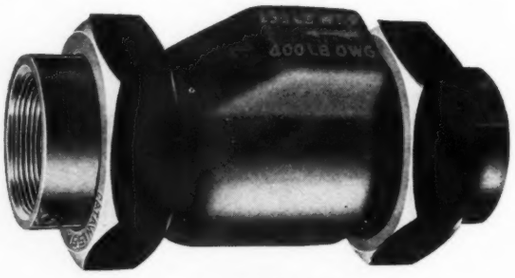
CATAWISSA

UNION SWING CHECK VALVES

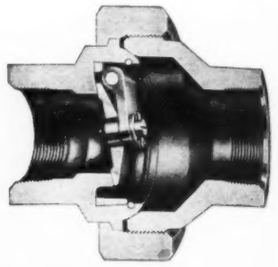
For Flow Lines—Boiler Lines—General Service



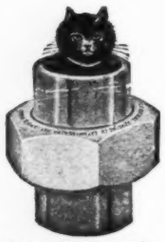
NO. 200 STANDARD OR REGULAR VALVES — for general use. Has union connection on the outlet end. Refax metal body. 250 lbs., W. S. P. 400 lbs., O. W. G. Sizes ¾" to 3".



NO. 210 DOUBLE UNION SWING CHECK VALVE — Flow line type for general use. In either horizontal or vertical positions. Specially adapted for lines in which no stop is installed close to the check valve. For 250 lbs., W. S. P. and 400 lbs., O. W. G. Sizes ¾" to 3".



NO. 350 EXTRA HEAVY VALVE — specially adapted for boiler feed lines. Eliminates the necessity of an additional union and nipple, as opening the union nut opens the line. Union is equipped with forged steel nut or lug nut, Integral Refax metal seat, and Hitensiloy forged flapper an flapper arm. Made in 2" size only. For 350 lbs., W. S. P., and 750 lbs., O. W. G.



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Stocked by all Oil Well Supply Co. Stores in all Fields

THE CENTRAL FORGING COMPANY, Catawissa, Pa.

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LEATHER

VALVE and PUMP

CUPS

SINCE 1912

THE PREMIER CUPS IN THE OIL FIELDS

Complete Line of Leather Specialties

MANUFACTURED BY

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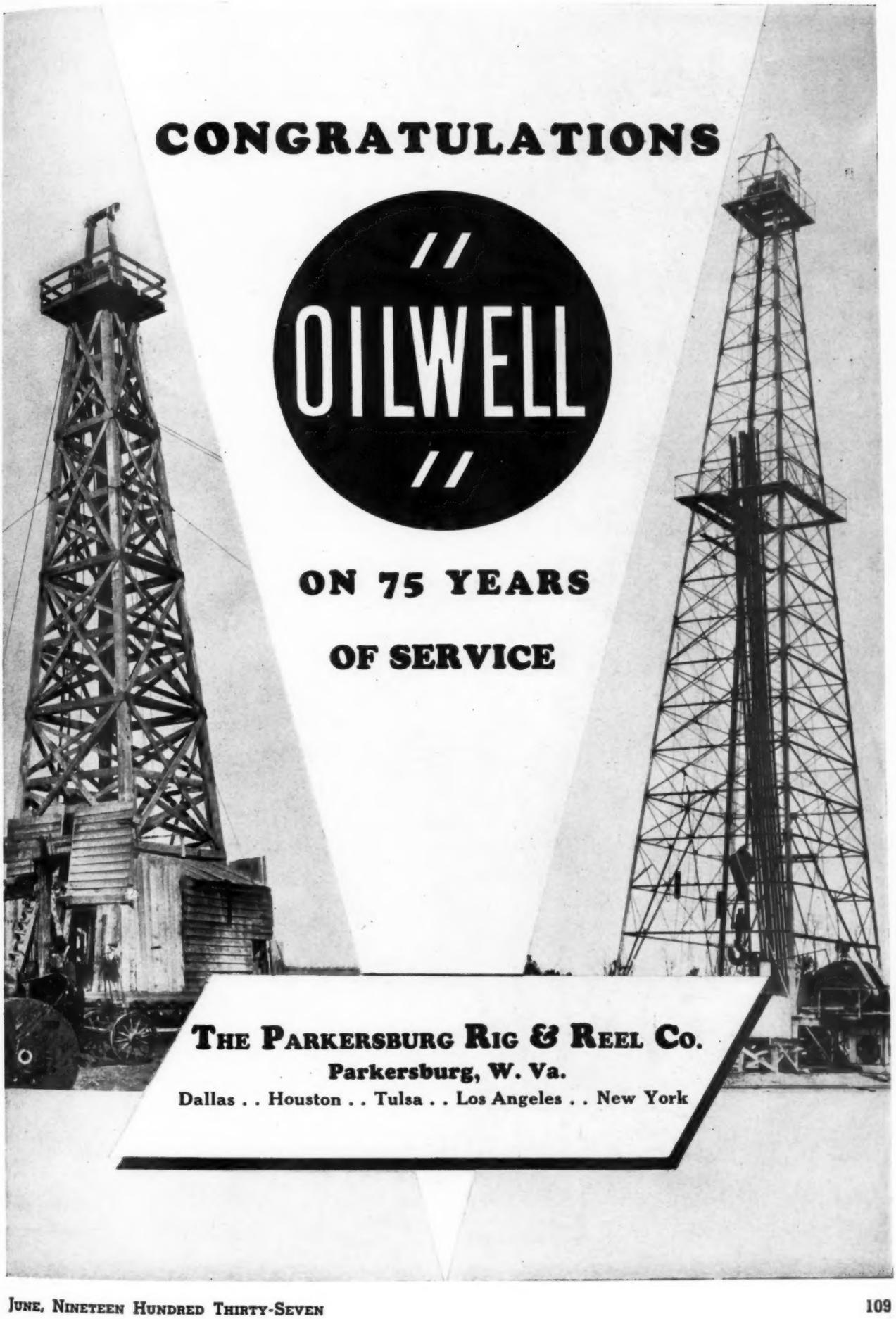
AMERICAN NUT & BOLT FASTENER CO.

PITTSBURGH, PENNSYLVANIA

World's Most Complete Washer Service

CONGRATULATIONS



OILWELL

ON 75 YEARS

OF SERVICE

THE PARKERSBURG RIG & REEL CO.

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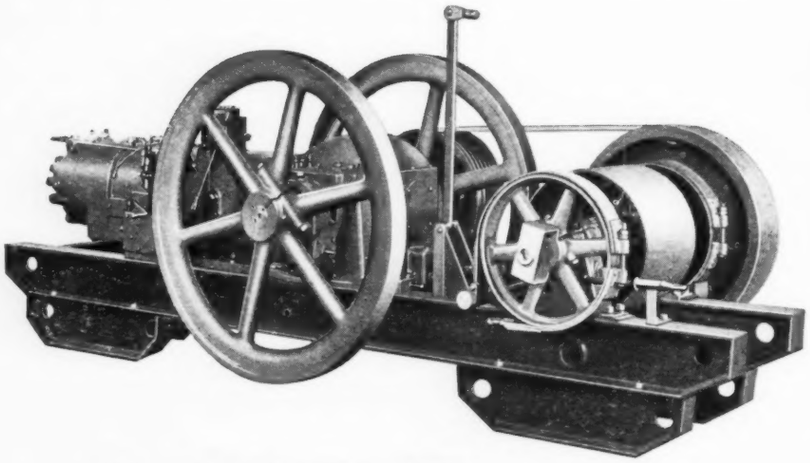
Dallas . . Houston . . Tulsa . . Los Angeles . . New York

FRANKLIN VALVELESS



DRILLING UNITS

for Operations

to 6,000 Feet—Simple . . . . Sturdy . . . . Economical . . . . Portable . . . . Dependable

These units are used for cable tool drilling. Franklin Valveless simplicity and dependability in every part. Both engine and type D reverse clutch are completely enclosed and all bearings and gears run in a constant bath of oil. When in neutral, the shaft stops rotating. Flat belt pulley may be changed to a desired diameter in the field without disturbing any other part of clutch.

Ask for Bulletin for full details or consult our Distributors. This unit saves on foundation cost, is easily installed and operates with great economy, enabling you to drill Faster and Cheaper.

ACG COMMERCIAL ENGINE

Gas or Oil

14 x 15" or
15 x 15"

A sturdy, simple, dependable prime mover, readily convertible from Gas to Oil fuel. This engine was designed to meet the many requirements for a prime mover for driving powers, compressors, pumps or any installation where power is required. A miser on fuel, a stranger to the repair shop, and a glutton for work, the type ACG Engine enjoys an enviable reputation that can only be fully appreciated by users.

Why not secure full particulars on these Units—it will save you money and their use will give you efficiency, economy and dependability, regardless of fuel or operating conditions.

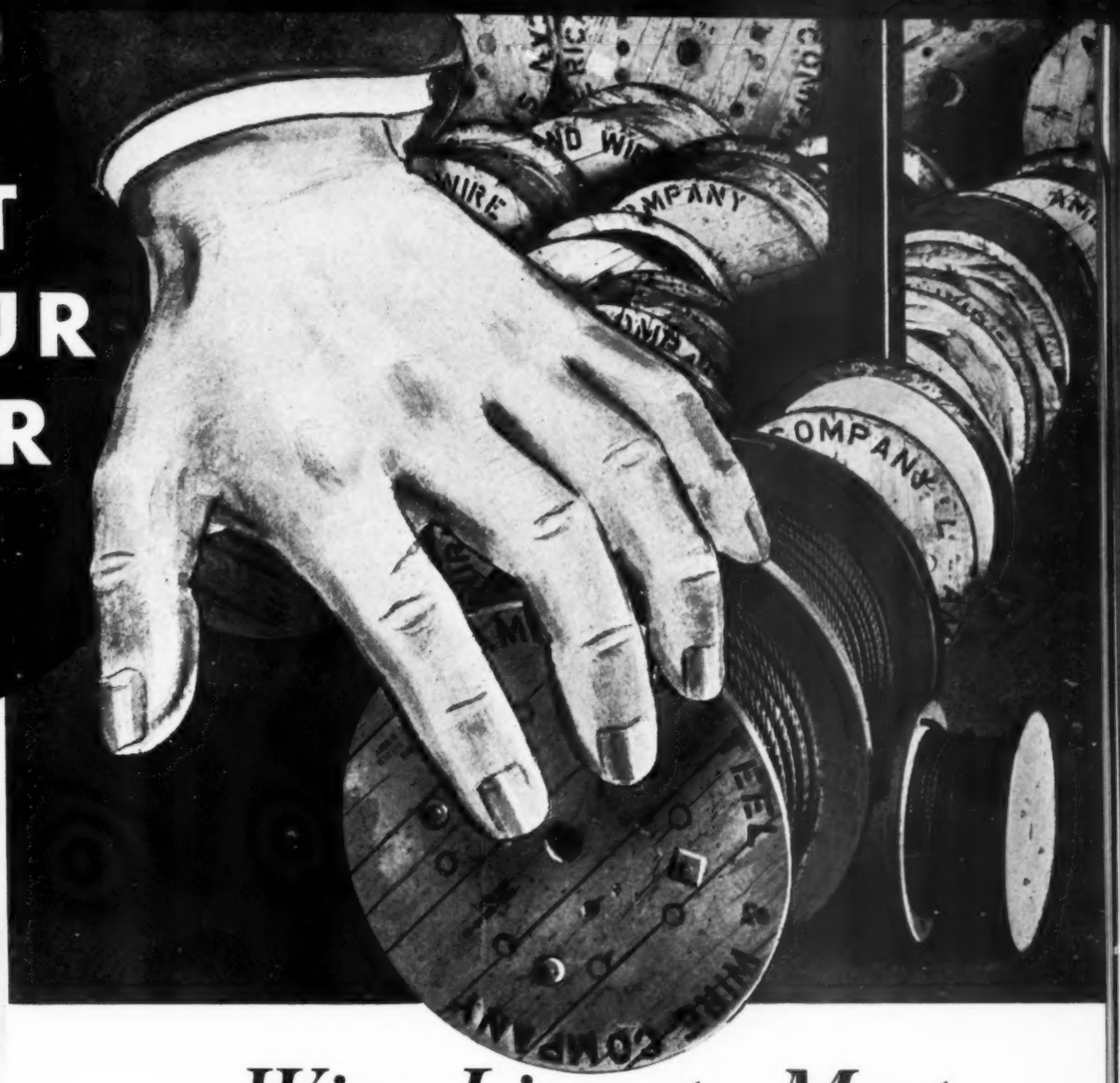
FRANKLIN VALVELESS ENGINE COMPANY

FRANKLIN, PENNSYLVANIA, U.S.A.

Distributed by

OIL WELL SUPPLY COMPANY

RIGHT AT YOUR FINGER TIPS



...Wire Lines to Meet EVERY NEED

WIRE LINES waiting for your call—instantly available to meet every need or emergency.

That's the kind of "finger tip" service provided for you by our distributors located throughout the oil fields. Complete stocks are on hand—you have only to phone to be assured of instant action.

And—in addition to prompt service—when you order American Tiger Brand Wire Lines—you secure the highest possible quality, which means lower operating costs and less time out for replacements. You can't go wrong—because every one of these wire lines is specifically designed to perfectly accomplish the task intended for it.

Today — tomorrow — whenever you need Wire Lines — specify American Tiger Brand.

AMERICAN TIGER BRAND WIRE LINES

- DRILLING LINES
- SAND LINES
- CASING LINES
- PUMPING LINES
- SWABBING LINES
- SUCKER ROD LINES
- COKE CHAMBER LINES
- TUBING LINES
- TORPEDO LINES
- ELECTRICAL WIRES AND CABLES

U·S·S AMERICAN TIGER BRAND WIRE LINES

AMERICAN STEEL & WIRE COMPANY
Rockefeller Building,
Cleveland

COLUMBIA STEEL COMPANY
Russ Building, San Francisco

United States Steel Products Company, New York
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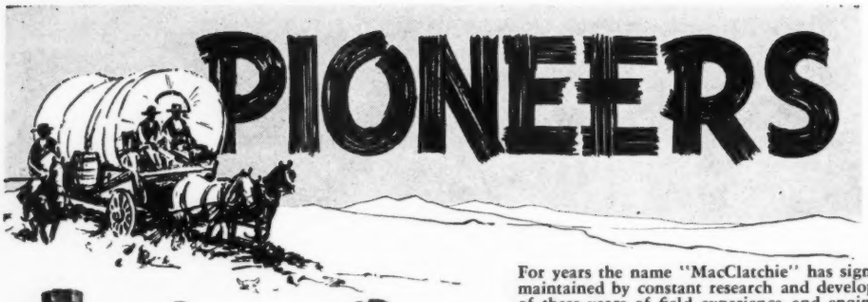
UNITED STATES STEEL



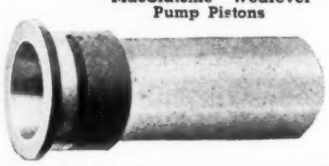
PIONEERS IN *Better* PUMP PERFORMANCE

MacClatchie Special Taper Rod

MacClatchie Plug Valves

MacClatchie Pump Valves

MacClatchie "Wearever" Pump Pistons



MacClatchie "Money Saver" Pump Liners

For years the name "MacClatchie" has signified the best in pump performance—a reputation maintained by constant research and development. The pump parts shown below are products of these years of field experience and engineering leadership—each is a superior product that gives extra service and definitely cuts your pump maintenance costs!

MacCLATCHIE STREAMLINE MUD PUMP VALVES are the recognized standard of the industry. Their streamline construction gives unobstructed fluid flow entirely free of lodging areas to collect and impair the proper closing of the valve. Their larger metal striking surface, absorbing the entire blow of the valve assures longer life without hammered-out spots to throw valve out of alignment. Their easily replaced rubber inserts provide a fluid-tight seal, and can be reversed for additional long wear. On the Pacific Coast alone four of the five largest operators use MacClatchie "Streamline" Pump Valves for 95% of their pump requirements!

MacCLATCHIE SPECIAL TAPER RODS are high quality rods, manufactured to the highest precision standards, being made of ball race steel tempered to an extreme hardness and ground to a perfect finish. Made in MacClatchie taper, any pump manufacturer's taper and also standard universal taper.

MacCLATCHIE "WEAREVER" PUMP PISTONS have two outstanding features—*Replaceable Rubbers:* The piston is renewed at will, effecting a remarkable savings over one-piece pistons. *Liner Protectors:* All the steel parts in the MacClatchie Piston are separated from the liner by either the piston rubbers or the liner protectors. These protectors are "L" shaped brass rings, vulcanized securely to the back side of the rubbers, and when assembled overlie the steel center of the piston, thereby protecting both the liner and the piston—greatly prolonging the life of both.

MacCLATCHIE "MONEY SAVER" PUMP LINERS are made of *special alloy* seamless steel tubing, hardened by a special process, and ground to a mirror finish. Under actual tests by engineers of major oil companies, "Money Saver" Liners have outrun costly spun metal liners, yet they sell for about half the price other manufacturers charge for ordinary forged steel liners. MacClatchie's exclusive manufacturing method, made possible by a tremendous volume of liner business, cuts costs to the bone yet produces a superior product. Next time you put in liners, try "Money Savers"—you'll like them right from the start!

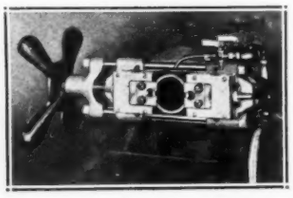
MacCLATCHIE MUD PUMP PLUG VALVES are designed especially for use in pump manifolds and give long leak-proof service under the highest pressures. Moreover, they are carefully engineered to withstand the cutting action of abrasive circulating fluids. Look into these for lower plug valve costs!

MacCLATCHIE MANUFACTURING COMPANY

COMPTON, CALIFORNIA — HOUSTON, TEXAS

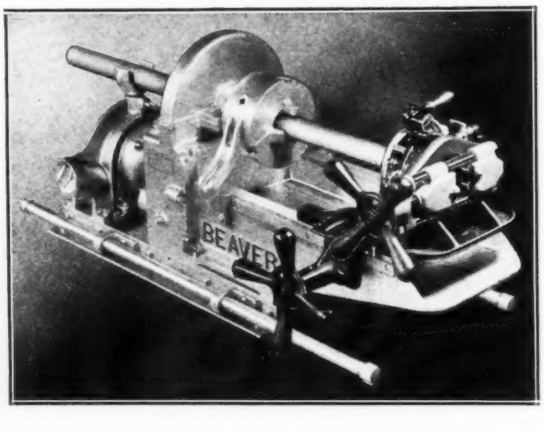
Export: Geo. R. Woods, 17 Battery Place, New York City

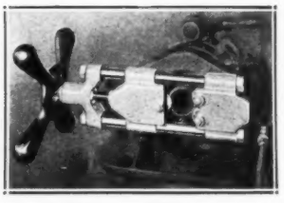
Your Choice—and at the same price!



Knife Cutoff

The automatic-feed knife cut-off, interchangeable with the wheel cutter by removing one set screw, is preferable for cutting soft electric conduit. It is necessary for "beveling" pipe, for welding and for "grooving" pipe for Victaulic joints — the latter use requiring special knives.





Wheel Cutoff

The wheel cutter renders "double" utility—since it will cut off both pipe and solid round bars. Moreover, it is simple, fast and foolproof. A single cutting wheel costing only a few cents will give months of service. The slight burr is instantly removed by a swinging cone reamer.

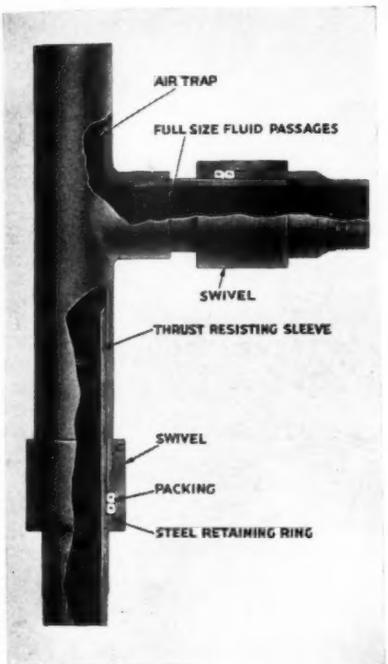
The BEAVER Model-A which led the way with such important improvements in small pipe machines as (a) rack-and-pinion feed, (b) quick-opening adjustable dieheads, (c) full 1/8- to 2-inch range, (d) double-duty-pipe and bolts, (e) right hand operation — now establishes another new precedent — the choice of interchangeable wheel-and-roller or automatic feed knife cutoff at the same price. Either of these cutters can be removed and used right up to the chuck for cutting short lengths — a patented Beaver advantage.

Write for New, Complete Pipe Machine Catalog!

BEAVER PIPE TOOLS

637 Petrol Avenue — The Quality Line—Since 1900 — WARREN, OHIO

DRILLING AIDS *that are* SERVICE-TESTED *and* ECONOMY-PROVEN



PATTERSON-BALLAGH PROTECTORS

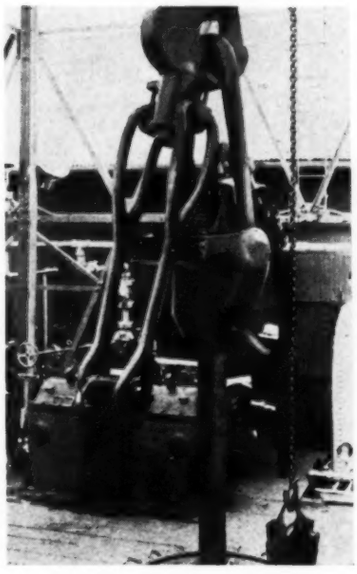
Protectors to drill pipe are what lubricant is to an automobile. Strain is reduced throughout the string. The pipe is given a cushioned protection which equally protects the casing. Less power is required to rotate the pipe. Fewer twist-offs occur. Faster drilling is done. By selecting Patterson-Ballagh Protectors, longer life is added to drill pipe. The same Protectors can be used in several wells, and the savings on each drilling job will repay the cost of the Protectors.

Patterson-Ballagh SAFETY MUD GUN

Assures better jetting of mud. No threads to wear. Packing is easily taken up or replaced and is locked after being taken up. A long vertical inside sleeve takes the side thrust. An air trap eliminates sand-cutting. This safety device has been widely adopted in the highest gas pressure areas in the U. S.

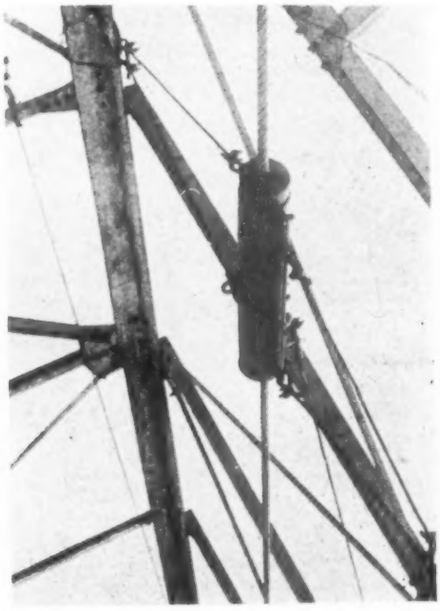
These Products Available at OIL WELL SUPPLY STORES Patterson-Ballagh Corp.

Plant and General Offices: 1900 E. 65th St., Los Angeles, Calif. *New York Office:* 39 Cortlandt St. *Oklahoma Office:* Oklahoma City, 1704 N. W. 17th St. *Texas Office:* Houston, 1507 Maury St. *Louisiana Office:* Box 23, Oil City, Louisiana.



Patterson-Ballagh SWIVEL BUMPER

Gives protection to elevator links and swivel. Prevents cutting of elevator links, also flange and bail on swivel. Keeps links centered on hook to prevent undue wear.

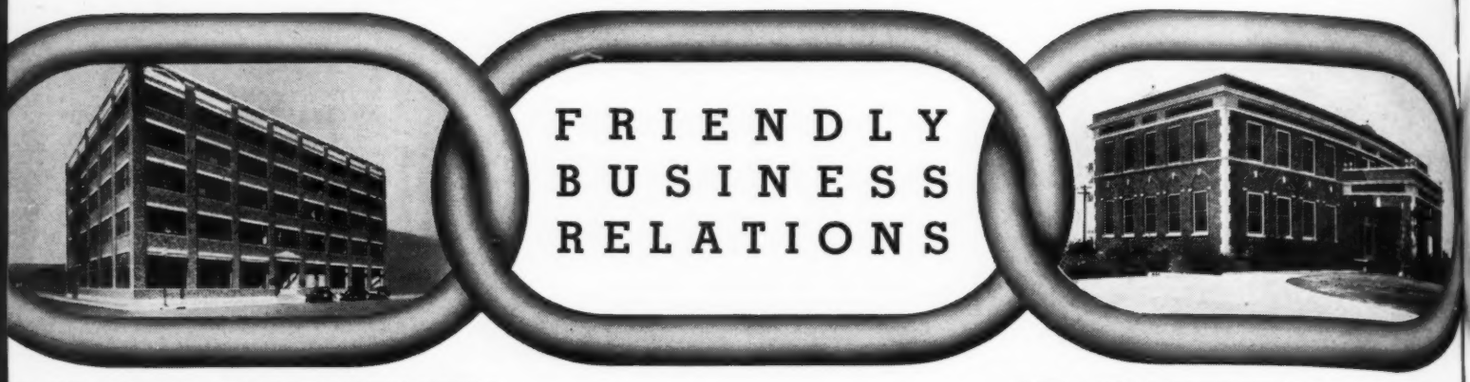


Patterson-Ballagh WIRE LINE GUIDE

Permits uniform spooling of wire line. Eliminates whipping. Increases life of line. Easily installed in derrick. Spark-proof. Embodies tough rubber retaining sleeve in which wire line runs.

MAKING OIL WELL HISTORY

75 YEARS OF SERVICE — **25 YEARS OF SERVICE**



E OIL WELL SUPPLY COMPANY
Dallas, Texas

THE GUIBERSON CORPORATION
Dallas, Texas

Congratulations!

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DIAMOND JUBILEE

from THE GUIBERSON CORPORATION

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Forty Years in the Oil Business—25 Years Making Oil Field Specialties—Guiberson Has Now Entered Its Second Generation of Service

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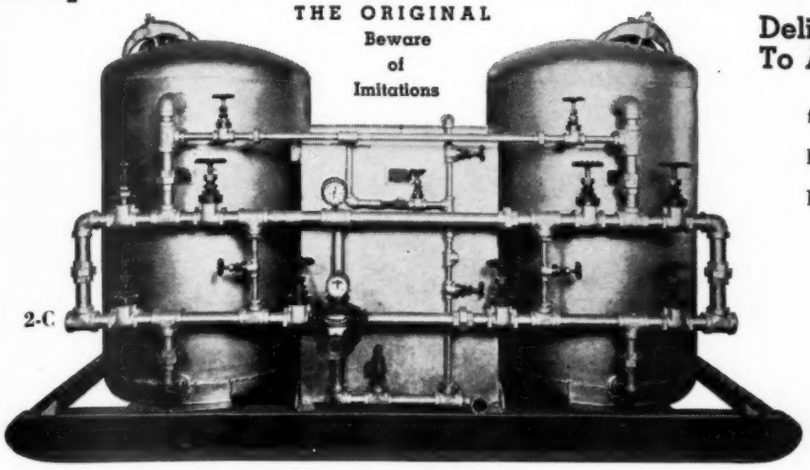
THE GUIBERSON CORPORATION

Royal Portable H. P. Zeolite WATER SOFTENER

THE ORIGINAL
Beware
of
Imitations

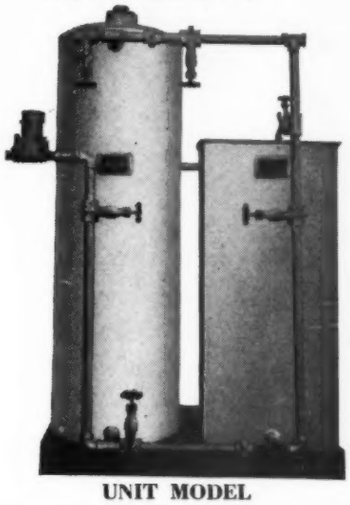


2-C

Delivers Zero Hardness Water To Any Location Economically

Removes all scale forming elements from feed water and prevents corrosion.
Models built up to 350-lb. Working Pressure.
Used on Lease, Production, Pipe Line Engines and Boilers.

Shipped by rail or delivered on job by truck. Service engineers in all fields.



UNIT MODEL

ROYAL PRODUCTS:

Zeolite and Lime Soda Systems.
Royal 900° Aluminum Paint.
Royal 700° Black Boiler and Stack Paint.
Royal Special Formula Water Treatments.
Royal Roof Coating and Boiler Wall Coating.
Royal Tool Joint Dressing.

ATTENTION DRILLING CONTRACTORS
Write for information on Portable Softeners for Rigs

ROYAL MFG. CO. Box 693, Tulsa, Okla.

"Manzel"

Force Feed Lubricator

For positive Lubrication of Cylinders and Bearings

5-Pint, Single-Feed Model "25"

Designed especially for oil field service.

Delivers oil to the cylinder regardless of steam pressure, temperature, or kind of oil used, and always in exact proportion to the speed of the engine.

Will supply plenty of oil for the heaviest duty engine or pump, yet may be regulated to supply a fractional part of a drop when used on compressors requiring very little oil.

Built to withstand hard usage and pump against high pressures.

All working parts completely enclosed.

Any unit may be removed from reservoir without stopping the lubricator or interfering with other units.

Has large, clear vision sight glass which shows at all times exactly how much oil is being supplied.

Extra large reservoir capacity, large filling cup and wide range of feed. Each feed is regulated independently.

Made with one to 30 feeds.

Write for Catalogs

Manzel Brothers Company

291-293 Babcock Street Buffalo, New York

"Manzel"

Chemical Feeder

For Injecting Treating Compounds into Crude Oil Lines

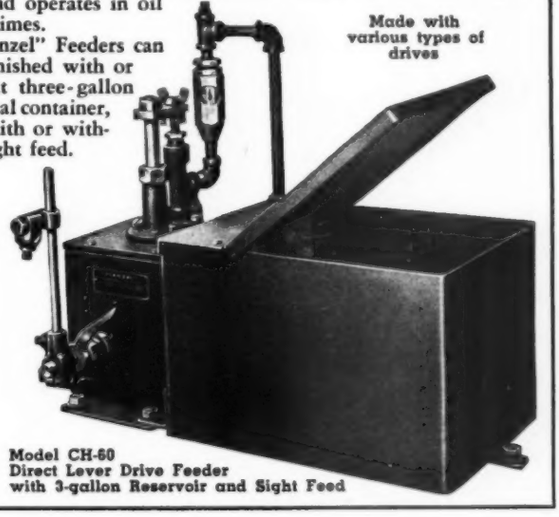
A positive pump for automatically measuring and delivering just the right amount of chemical into crude oil lines.

Feeds the chemical in exact proportion to the amount of oil being pumped, delivering small or large amounts with unfailing regularity.

The pumping unit is readily accessible and is the only part that comes in contact with the chemical. It is a simple single plunger pump fitted with the "Manzel" patented piston valve, the most satisfactory type of valve for handling treating chemicals. The entire driving mechanism is enclosed in an oil-tight case and operates in oil at all times.

"Manzel" Feeders can be furnished with or without three-gallon chemical container, also with or without sight feed.

Made with various types of drives



Model CH-60
Direct Lever Drive Feeder
with 3-gallon Reservoir and Sight Feed

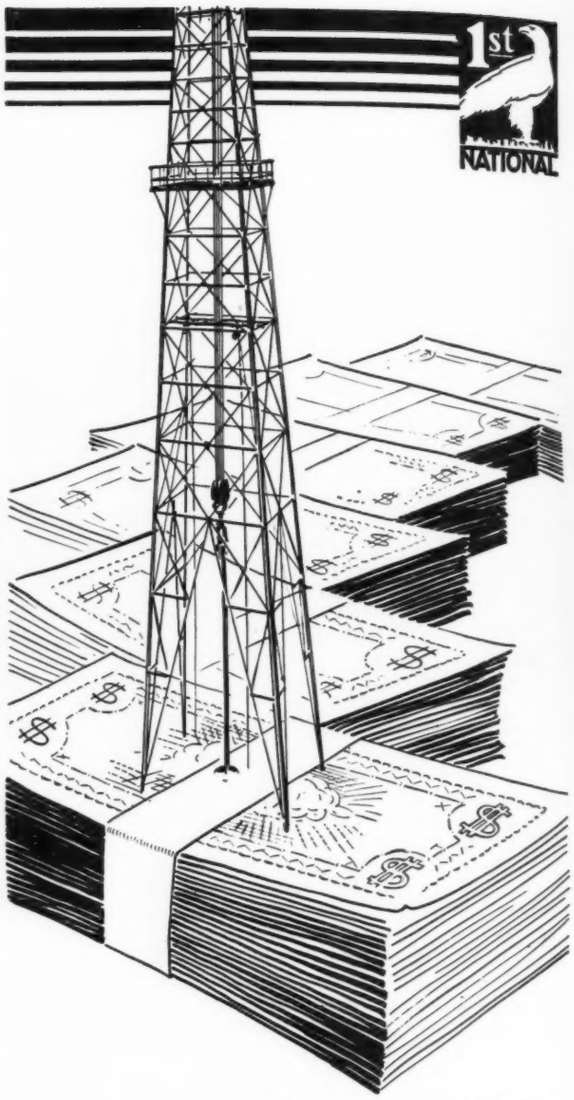
Chairman OF THE BOARD OF "Directions"

ON SAFETY TOOL NAME PLATES

TAKE a look at the directions on this name plate and you'll see why any member of a crew can't go wrong in setting the SHEAR-RELIEF Valve. There's the pump pressure at which each nail size shears, and there's the nail gauge to prevent mistaking nail sizes. Position of the set nail is shown at the right, and the instructive name plate is only one of the numerous features which have put the SHEAR-RELIEF Valve on pumps all over the oil world.

Showing the high pressure type for slush pumps.

FLUID-PISTON SLUSH PUMPS
ABERCROMBIE PUMP CO.
GULF BLDG. HOUSTON TEX.



OIL DOLLARS

Oil money flows into this bank by the millions. Together with other deposited dollars, it is loaned back to further develop its own industry in which this oil-minded bank is vitally and deeply interested.

FIRST NATIONAL BANK IN DALLAS

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AMSCO Sheaves—

for "Oilwell" No. 200

Part of an order for 450-36" O. D. AMSCO Manganese Steel Sheaves for the Oil Well Supply Company are pictured. These Sheaves for use in "Oilwell" Blocks, are interchangeable in their "66" Streamline Traveling Block and No. 200 Crown Block.

The unusual wear-resisting quality of AMSCO Manganese Steel Sheaves is due to the inherent toughness and closely knit structure of the steel and to the unusual property which Manganese Steel possesses of becoming more compact and hard on the surface when subjected to pressure or impact.

AMSCO Manganese Steel will surface-flow somewhat under great pressure, or impact, but to a great extent this flow very rapidly hardens, resulting in a hard wear resistant surface (with a ductile backing) which is self-renewing, for as soon as a given layer is worn away the next layer, as it becomes surface, at once hardens under the pressure.

In a Sheave of Manganese Steel, the groove surface instead of breaking off in tiny splinters under pressure and wear, as is the case with other metals, takes on a glass-like polish. This means that the groove wears out more slowly and there are no metal particles to imbed themselves between the rope strands. Wire rope used with AMSCO Manganese Steel Sheaves will last, conservatively 25 percent longer than with ordinary Sheaves.

Be sure—for longest life in both sheave and cable, insist upon AMSCO MANGANESE STEEL SHEAVES—they will save you a lot of money and trouble.

AMERICAN MANGANESE STEEL COMPANY

Division of The American Brake Shoe & Foundry Company

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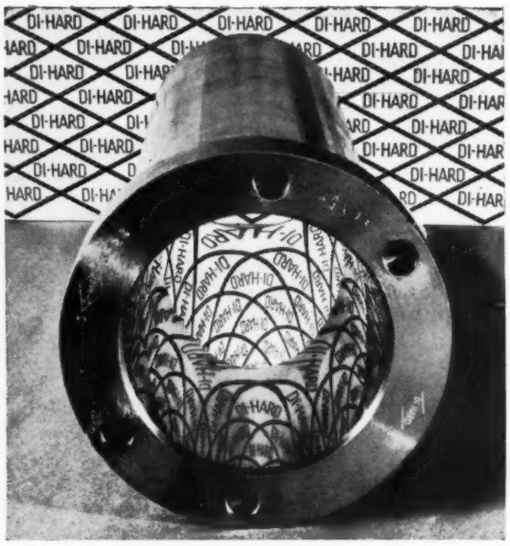
Foundries at Chicago Heights, Ill.; New Castle, Del.; Denver, Colo.; Oakland, Calif.; Los Angeles, Calif. • Offices in Principal Cities

AMSCO

TRADE MARK REGISTERED

Crown Blocks and "66" Streamline

Traveling Blocks



"OILWELL" DI-HARD SLUSH PUMP LINERS

The steel liner with internal inlay of I. R. Metal — precision honed to a ***mirror finish*** and ***having absolute uniform surface and depth hardness of***

900 DIAMOND BRINELL

OUTWEAR heat-treated steel liners ***4 to 5 times*** as repeatedly proven by revolution counter tests and field service operating records.

INCREASE PISTON LIFE — Liners that ***don't score*** save piston wear.

STANDARD EQUIPMENT for "OILWELL" Pumps. Specified replacements for most majors, independents and contractors who have used them once.

NOW AVAILABLE for **GARDNER-DENVER** Slush Pumps through authorized **GARDNER-DENVER** distributors exclusively.

Fully Patented

MANUFACTURED BY

OIL WELL SUPPLY CO.

UNDER EXCLUSIVE LICENSE FROM

INDUSTRIAL RESEARCH LABORATORIES LTD.

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**Industrial Research Laboratories have prepared a detailed report on the metal and process used in the manufacture of DI-HARD Liners. This report also fully describes various other important products and commercial uses for the metal and process, and will be sent on request.*

JERGUSON

Makers of

REFLEX GAGES

That Are Ideal for

Gasoline, Kerosene, Steam, Oil, Etc.

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DIAMOND JUBILEE

NO MATTER what the color of the liquid, in Jerguson Reflex Gages

The LIQUID Level
SHOWS
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and the . . .
EMPTY SPACE
APPEARS
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Safe and durable at highest pressures and temperatures. Furnished with or without valves for every type of service.

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GAGE & VALVE CO.

Mystic Ave. and Northern Artery

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MANUFACTURERS OF WRENCHES SINCE 1835

COES GENUINE SCREW WRENCH "Knife Handle" No. 92

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MAKERS OF A COMPLETE LINE ALL STYLES ··· ALL SIZES

Quality Wrenches

SPRINGFIELD, MASS.

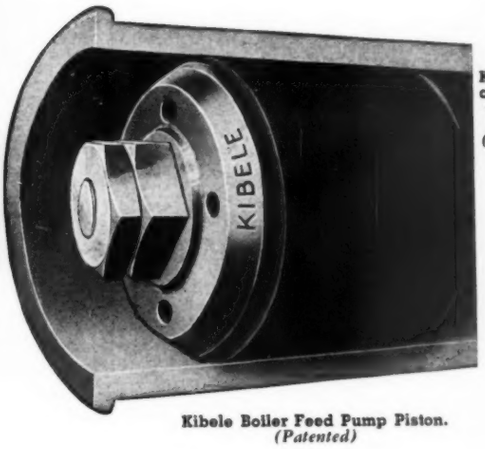
The Perfect Sale *Is the Repeat Order*

Kibele 2-Step Tubing Catcher for wells less than 4000 feet deep. *(Patents Pending)*

Our supply company friends, with their complete stocks of Kibele products throughout the oil country, offer best evidence that there is many a repeat call for KIBELE TUBING CATCHERS, FLOW HEAD PACKERS, SWABS AND PISTONS.

For detailed information on all Kibele Products see pages 983-986 Composite Catalog.

Kibele 7-in. Two-cup Casing Swab with Automatic Relief Valve *(Patents Pending)*



Kibele Boiler Feed Pump Piston. *(Patented)*

Kibele 2½" Tubing Swab

Export Representatives:
CONTINENTAL-EMSCO CO., 30 Rockefeller Plaza, New York, N. Y.

KIBELE

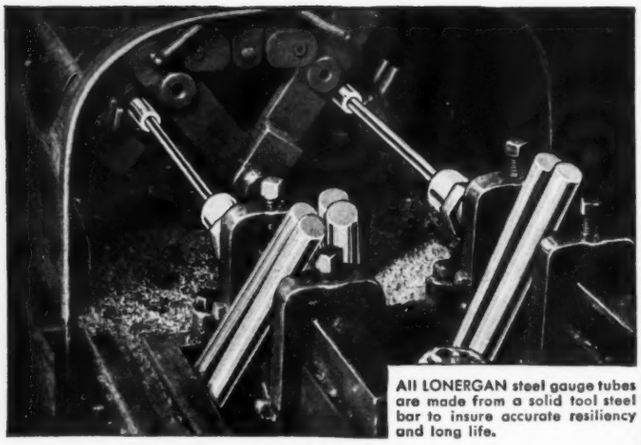
MANUFACTURING COMPANY

FLUID EXPANDING PUMP PISTONS — SWABS and TUBING CATCHERS

A KIBELE DOESN'T COST.... IT EARNS

5101 MAPLE AVE. DALLAS, TEXAS

(Pronounced KIBLEY)



All LONERGAN steel gauge tubes are made from a solid tool steel bar to insure accurate resiliency and long life.

PRECISION

IS THE "WATCHWORD" OF

THE LONERGAN PLANT

MODEL "OHP" POP SAFETY VALVE

Made in 2" pipe size only, with bronze body; Benedict Bronze seats, discs and adjusting rings; spring entirely encased and does not come in contact with steam. Suitable for 350 lbs. pressure.

Solid tool steel is accurately drilled and tooled to within 2/1000 of an inch of the specified standard in making tubing for models "HRG", "LRG" and "GH" LONERGAN Gauges. Connecting parts are all tinned before soldering to insure leak-proof performance. All LONERGAN Gauges are triple-tested to within 1% of absolute accuracy. This precision in manufacture with only the highest grade materials has made LONERGAN Gauges "standard equipment" wherever the best gauges are required. For replacements or new equipment see your local distributor or write us direct.

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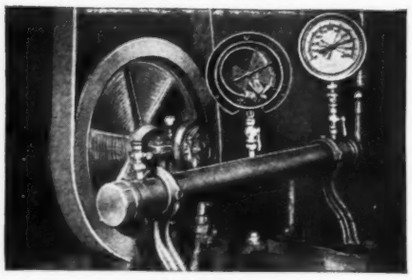
Second and Race Sts. • Philadelphia, Pa.

300 Specialties for Power Plants Standard Since 1872

MODEL HRG HIGH PRESSURE GAUGES

THE LONERGAN WHIP TEST

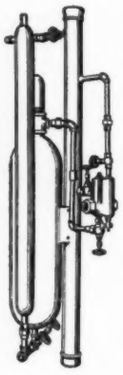
has been conducted on the same Lonergan Gauge, 82 pulsations a minute, 8 hours a day since July 22, 1936. This gauge is still in perfect condition — undeniable proof of the stamina and inbuilt supremacy of LONERGAN Gauges.



Lonergan

GAUGES · VALVES · SPECIALTIES

YOU'LL FIND BADGETT



- STEAM LINE LUBRICATORS
- STEAM ENGINE LUBRICATORS
- AUTOMATIC STACK BLOWER CONTROLS
- AUTOMATIC GAS-FIRE AND STEAM CONTROL REGULATORS
- CHEMICAL LUBRICATORS
- HAMMER UNIONS

at **"OILWELL"**

Badgett Steam-Line Lubricators and Steam Engine Lubricators are low in cost, give perfect lubrication, and have no working parts—there is nothing to get out of order and cause serious and costly delays.

Investigate the advantages of Badgett equipment—It will pay for itself with the savings it makes. Export and domestic orders handled through your supply store. Catalog sent on request.

BADGETT STEAM LUBRICATOR CORP.

Box 160 Chickasha, Okla.

CLEMSON BROS.

INCORPORATED

MANUFACTURERS OF

STAR "Moly" hack saw blades

extend

CONGRATULATIONS

to the

OIL WELL SUPPLY CO.

on the occasion

of their

DIAMOND JUBILEE

TOUGH!

A NEW Ratchet Gravity Lowering hoist especially designed to meet the rough and tumble working conditions of every oil field application.

This hoist can take a licking that the toughest two-fisted field workman can give—and come up smiling every time.

The Model R-G-L is particularly adapted for raising and lowering pipe, bending pipe, skidding heavy machinery, loading and unloading trucks, and so forth. It is convertible into 2, 4, and 6-ton capacities.

Inquiries are invited. Write direct to the factory for details.

MODEL RGL

- RATCHET LEVER
- SPUR GEAR AND
- ELECTRIC HOISTS

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COFFING HOISTS

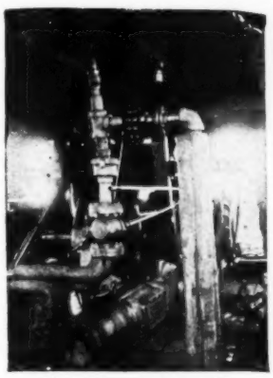
ADVANCED DESIGN

COFFING HOIST CO., DANVILLE, ILLINOIS

Figure 1010

The
EVERLASTING VALVE

Serving on most Oil Field Boilers because Regular Everlasting Valve is easy to operate; stays tight. The Disc rotates with each opening and closing, regrinding Seat and Disc, cleansing and hardening both faces.



3" Emergency Throttle

Supplied in 1", 1¼", 1½" and 2" sizes Fig. 1000 for boiler blow-off on low pressure boilers. On high-pressure boilers (over 250 lbs. to 350 lbs.) install Rack and Pinion Type Fig. 1010, Cast Steel. Everlasting Valve is manufactured both Screwed and Flanged. Sizes ¼" to 16".

Drilling Contractors install 3" or 4" Regular Everlasting Valve as EMERGENCY THROTTLE SHUT-OFF to immediately shut off steam supply to drilling engine in emergency. The link-rod or cable is arranged to carry the control to the Engineer. Specify "Emergency Throttle Service" on each order and state pressure.

EVERLASTING VALVE CO.

Jersey City, New Jersey

In Canada: Everlasting Valve Co., Ltd., Toronto

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for crank pin bearings,
eccentric straps, etc.

LAMINUM SHIMS provide accurate adjustments . . . Right at the machine! Simply p-e-e-l one or more .003" laminations at a time from the solid brass shim. Production delays avoided . . . No filing, no grinding . . . • The same economy, the same precision in factory assembly and in every service adjustment for the life of the bearings.

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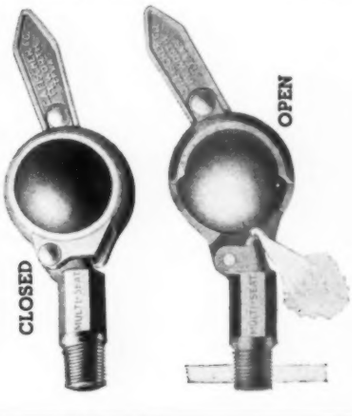
LAMINUM
Precision adjustment **SHIMS**

WE CONGRATULATE THE "OILWELL" ON ITS 75TH ANNIVERSARY

"THOUSANDS OF SEATS ON THAT BIG LEAD BALL"

"Multi-Seat" Boiler Gage Cocks are Standard factory equipment on "Oilwell" high pressure boilers and can be obtained at all

OIL WELL SUPPLY STORES



C. A. FISCHER CO.

P. O. Box 83 Fort Worth, Texas

Chiksan All Steel Rotary Hose
—Ideal for Pressure Drilling

THE *Swing* IS TO CHIKSAN

Boats . . . Docks . . . Refineries . . . Loading Racks . . . Chemical Plants . . . all have many places where fluid passes through movable pipes or hose lines . . . places where Chiksan Ball Bearing Swing Joints will provide greater ease and economy of operation. Double ball races in each joint serve two purposes . . . they allow free and easy swivel action by carrying all radial loads, and they keep the special packing element compressed at all times by maintaining a regulated thrust load upon it. Chicksan Ball Bearing Swing joints withstand all atmospheric conditions and handle all petroleum products without leakage. For a new standard of performance try CHIKSAN . . . the Streamlined Swing Joint. No projections to catch workmen's clothes, no bolts or nuts to become loosened, and nothing to interfere with complete 360-degree swiveling.

Write for Complete Descriptive Literature

Rotary Hose that will stand the gaff—that's the demand of today's high pressure wells. The safety of your men and equipment require the extra strength that all metal construction affords. Don't take chances with half way measures. Only in the Chiksan *All* Steel Rotary Hose do you get:

GREATEST STRENGTH

—The inherent strength of steel provides a positive safety factor.

LONGEST LIFE

—Steel is unaffected by oil and the elements.

LOWEST UPKEEP

—All metal construction eliminates the kinks and breaks to which conventional hose is subject.

FREEDOM FROM LEAKS

—A Duprene Packing Element in a patented packing set provides a positive seal, resists all fluids.

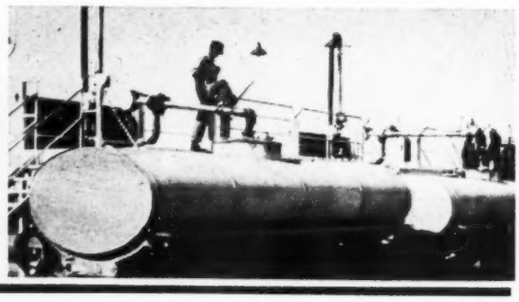
AMAZING FLEXIBILITY

—Seven joints with 17 swivel movements permit perfect 360 degree "swing."

For greater Safety, Flexibility and Economy use the Chiksan ALL Steel Rotary Hose

All Chiksan products are sold by Oilwell Supply Company

Chiksan
CHIKSAN OIL TOOL CO. LIMITED
FULLERTON, CALIFORNIA - GULF ENGINEERS INC., HOUSTON TEXAS



Lightweight and double rows of ball bearings make Chiksan Aluminum Swing Joints a joy to handle.

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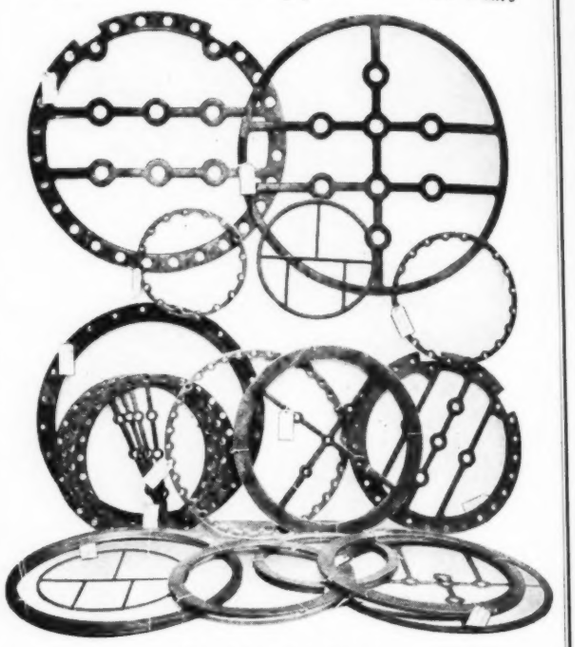
Used in the Oil Industry for the Past 35 Years



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AKRON METALLIC GASKET COMPANY
170 North Union Street Akron, Ohio

Specializing in

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WIPING CLOTHS
AND
WIPING WASTES
for the
PETROLEUM INDUSTRY

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BUY THRU YOUR SUPPLY STORE

Oklahoma Rig & Supply

- Accurate Gauge Poles
- Approved Hickory Handles

Gauge poles for oil field tanks and filling stations. Graduated in 1/8 and 1/4 inches. With or without non-sparking brass caps.

Second growth hickory handles approved by oil company safety departments.

All types filler cants for steel wheels.

All types wire-bound or nailed wooden shipping boxes.

OKLAHOMA RIG AND SUPPLY CO.

MUSKOGEE, OKLAHOMA

Congratulations

OILWELL

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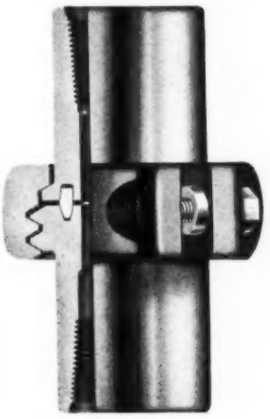

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Steel Tested 10,000 lbs.
Malleable Tested 4,500 lbs.

- Absolute Safety . . No Leakage
- New Taper Principle . . Equalizes Pressure

Used by practically all major oil companies

RED REX CORPORATION

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Swaged **NIPPLES** *and* **BULL PLUGS**

. . . Forged from highest quality A.P.I. specification pipe, 60,000-pound tensile strength . . Guaranteed for pressures for which they are made . . Tested to 6800-pound cold water pressure . . Extra long threads allow for take up . . Bull plugs have special reinforced solid-forged head . . Swage nipples have centimeter alignment of both ends.

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STAR BRAND
TACKLE BLOCKS

ALL TYPES
Especially Designed
for
OIL FIELD USE
for
Dependable Service

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For Sale by

Oil Well Supply Company
DALLAS, TEXAS

NATHAN

VALVELESS
MECHANICAL
LUBRICATORS

STANDARD
EQUIPMENT
ON
"OILWELL"
POWER

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NEW YORK
MAKERS OF LUBRICATING DEVICES
SINCE 1864

Applications of

RHODES METALLIC PACKING

Drilling Equipment — Slush Pumps (steam end only), Drilling Engines, Steam Rig Lighters and Boiler Feed Pumps (rod, both ends).

Pipe Line Equipment—Discharge Pumps both centrifugal and reciprocating at any speed or pressure (handling either crude oil, gasoline or butane). Fuel or Spray Valve Stems, Fuel Pump Plungers and Air Bottle Stems for Diesel Engines, Circulating Pumps and Sump Pumps.

AVAILABLE at OIL WELL SUPPLY CO. and other supply companies

RHODES METALLIC PACKING COMPANY
DETROIT, MICHIGAN

Stacy Load Binders

Faster, Quicker, Safer Binding
Through More Than 40 Years!

SWIVEL Joints make hooks easy to hook anywhere without twisting and subsequent breaking of chain. Made of malleable iron in 19 to 22-inch handle sizes, weighing from 7 to 14 pounds each and fitting any size chain up to ¾-inch, your dealer sells each STACY SWIVEL LOAD BINDER with a "Money Back" guarantee. Recognized by oil field and pipeline equipment users everywhere as the most useful thing of its kind in existence.

A Hundred Uses in Oil-field and Pipe-line Work

Bind pipe, rods, tubes, casing, separators, boilers, tank, rails, poles, logs, timbers, lumber, etc. Ideal for wire stretching, straightening, tightening. Useful in braking wagons, trailers, etc., in hilly country without backing up loads to slacken chain.

Prevent Accidents — Save Time and Trouble

Made by EUGENE C. STACY, Tiffin, Ohio

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Octagon Wood Rods and Wrought Iron Forged Couplings

WE have always devoted all of our energies toward doing one thing as perfectly as humanly possible: the making of octagon wood rods together with their wrought iron forged couplings.

Today—as always—the user of this Schweitzer sole product knows that he has the best that money can buy; that year after year Schweitzer Rods and Couplings do not vary in quality and that he can depend upon them for excellent service.

Rod sizes 1⅛" to 3½"; coupling and wrench square sizes ⅝" to 1½" for pipe sizes 2" up to 10". Random lengths 14 to 22 feet.

Distributed by
OIL WELL SUPPLY COMPANY

Made by
SCHWEITZER WOOD ROD COMPANY
Poplar Bluff, Missouri

SOUTH CENTRAL DRILLING CO.

Well Drilling Contractors

●

YEARS OF EXPERIENCE

plus

GOOD EQUIPMENT

is our guarantee to you that your well will be properly drilled.

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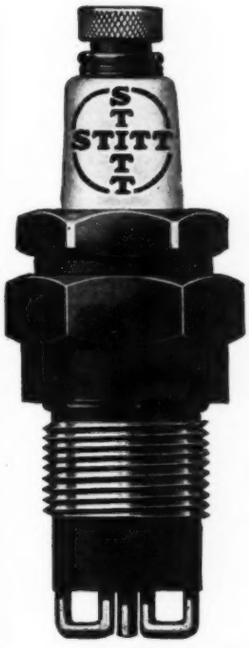
HEAVY DUTY

SPARK PLUGS



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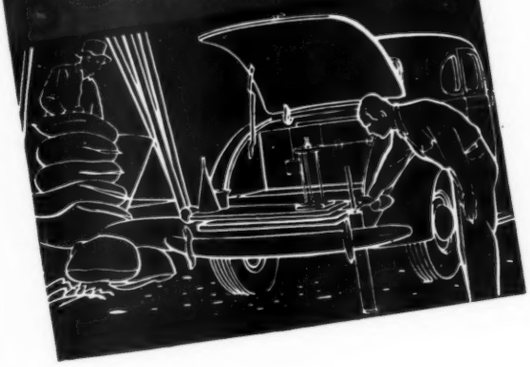

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